

# The Mining Journal

LONDON, MAY 9, 1958

Vol. 250. No. 6403.

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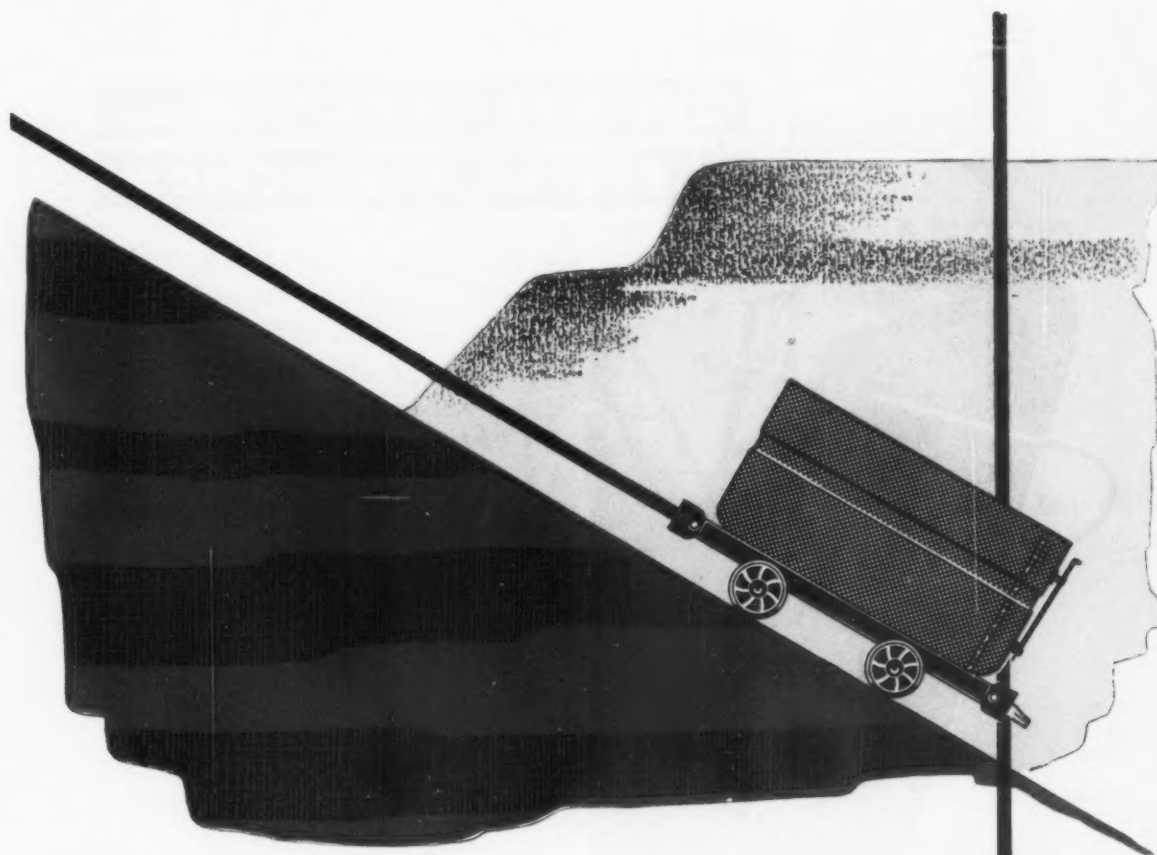
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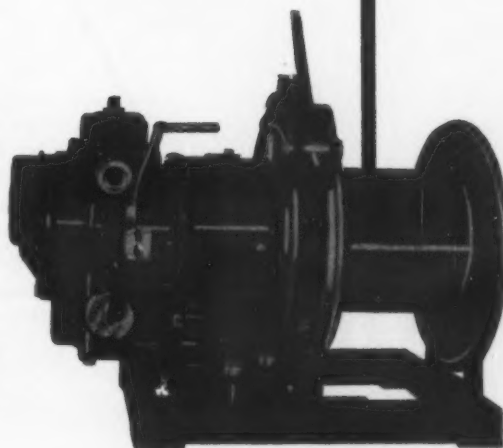


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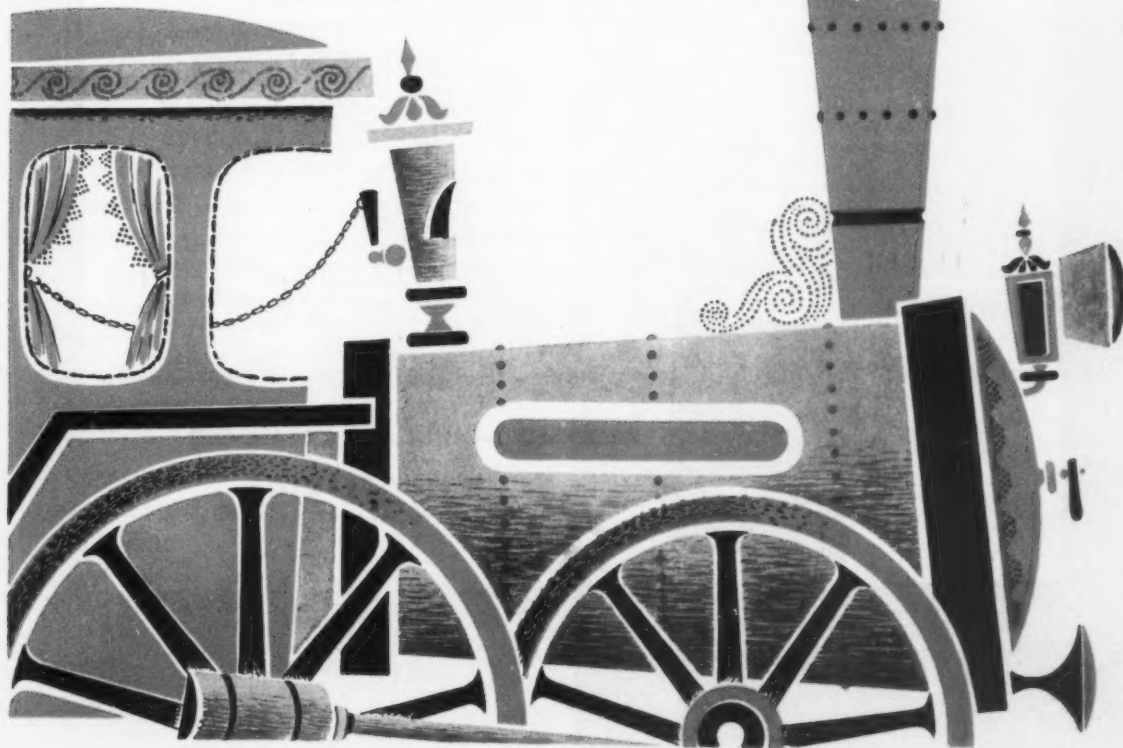
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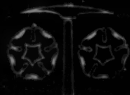


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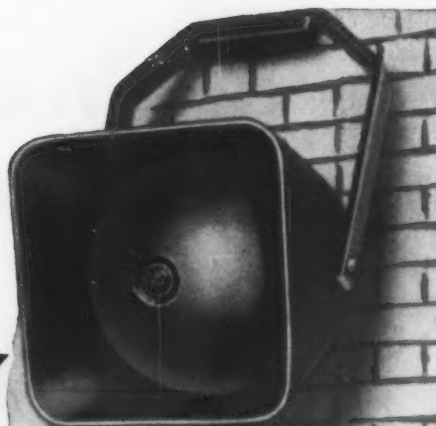
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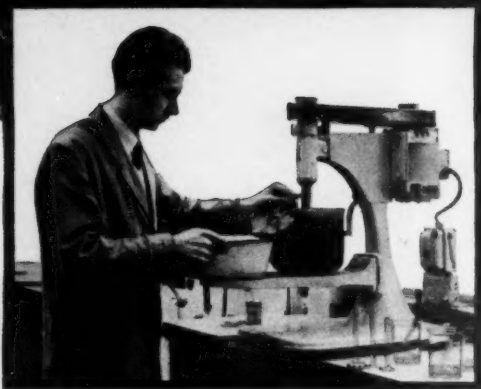
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# The Mining Journal

London, May 9, 1958

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### Joint Editors

U. Baliol Scott R. Bruce Dunfield

### News Editor

A. G. Thomson

### Assistant Editor

R. Bowran

### Display Advertisement Manager

E. S. Hooper

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Robert Budd

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E. Baliol Scott  
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U. Baliol Scott  
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## Making Bad Worse?

*" Ah, love, could'st thou and I with fate conspire  
To grasp this sorry scheme of things entire,  
Would we not shatter it to bits and then  
Remould it nearer to the heart's desire ? "*

Omar Khayyám

**I**T is one of the saddest of human failings that we never seem able to tackle our problems till they have become crises; by that time the problems have so grown in significance that it is difficult to maintain a sense of proportion in dealing with them. That, in a nutshell, is the explanation both of the rash of specifics for the world's mining industries that has appeared in the past few weeks and of why it is difficult to muster a great deal of confidence in the essential soundness for any one of them.

Much the most important—because the most likely to be put into effect—is the American Administration's proposed scheme for assisting the minerals industry. What the Administration is suggesting is that subsidy payments should be made to bring the prices of five minerals up to a minimum level for given tonnages. Thus copper, lead and zinc would be supported to the prices of 27.5, 14.75 and 12.75 c. per lb. respectively; fluorspar (acid grade) and tungsten would be supported to \$48 and \$36 per s.ton respectively. The maximum new-mined tonnages on which support would be available in any one year would be 1,000,000, 350,000, 550,000, 180,000 and 375,000 tons for copper, lead, zinc, fluorspar and tungsten respectively. (These figures may be compared with the 1957 outputs of 1,076,922, 333,493, 520,128, 192,000, and 378,000 tons again for copper, lead, zinc, fluorspar and tungsten respectively.) Thus, in fact, the Administration is offering a price support for almost all of the 1957 output of copper and rather more than the 1957 output of lead and zinc.

There is no question at all why this scheme has been thought up. It is to provide a way out for the President, since he is still unhappy about accepting the Tariff Commission's recommendations for increased duty on imports of foreign lead and zinc. Interior Secretary Seaton has said pretty plainly that the President will reject, or at least modify, the proposals of the Tariff Commission and has added that the scheme being put forward by the Administration is "by far preferable" to bigger import cuts such as some of the Tariff Commission also wanted.

It remains to be seen (a) whether the Administration will carry the day in this disagreement as to what should be done for the domestic mining industry and (b), given the fact that higher import duties would be a mistake, whether the proposal of the President might not turn out to be a worse one.

Already the scheme has run into fierce opposition from the mining interests. Their first point of complaint is that the level of the guarantees is pitched so low that it will not, in fact, save many mining properties from disaster. Few copper interests would be prepared to settle for a price below 30 c. per lb., for example. Others objected that the duration of the scheme—put at five years—is not long enough to give any security, especially as it is believed

that it will require an annual vote by Congress to provide the finances. The point in the scheme to which most objection is raised is, in fact, the absence of any price floor. Some mining interests have said that the scheme will lead to lower prices in that so long as the Administration makes up the price it does not really matter at what level the copper is sold.

The obvious effect, if price cutting of this kind were to develop, would be to freeze out the foreign producer. Indeed, the threat of unfair competition in the scheme as it stands at present is remarkably high. If the scheme offers a subsidy which is a potential threat to the trade of another country it will almost certainly be a contravention of G.A.T.T. On the other hand, if the scheme is modified to square it with the G.A.T.T. obligations of the United States, it may well lose all attraction as a protective device and founder for lack of domestic support.

But the United States is not the only country trying to solve its minerals industries problems at the expense of others. Things are warming up in Chile. The most interesting development is that a Bill now lies before the Chilean Congress which, if passed, would upset the present working basis of the copper industry by reason of its drastic amendments to the Copper Law. The Bill makes the following proposals:

- (1) The Banco Central de Chile should resume the sale of Chilean copper.
- (2) The minimum output on which the sliding scale of income tax begins to operate should be raised from 734,917,436 lb. to 990,000,000 lb.
- (3) Anaconda and Kennecott to return to Chile all foreign exchange earned by selling copper abroad.
- (4) Fifty per cent of what is loosely called "investor's profit" to be set aside to form a loan for the establishment of a national economic development fund.
- (5) The rebate of 10 per cent on copper sold to Chilean fabricators to apply to all tonnages sold without limitation (the present limit is 10,000 tons).
- (6) Goods imported by the companies to pay the normal rate of import duty (though it is not clear what is covered by this term).
- (7) A Chilean Metal Market to be set up at Iquique.

The best that can be said for this Bill is that it is so bad that its faults can scarcely be overlooked. They may still pass parts of it but there is so much that can backfire on them that the Bill looks a non-starter.

But this is not all that Chile is planning to do to get herself out of the difficulties created by the collapse of copper prices. She has made certain proposals to the International Trade Commission of the United Nations and these will have to be discussed in the Session now in being. First, Chile has called for some scheme for a stable supply and a stable price level for the metal. Secondly, she wants all member countries to declare that permanent international organizations are, in fact, legitimate and proper for governments to join (there is to be no backsliding—the Chileans are apparently saying—behind national anti-trust laws). Thirdly, she wants international agreement on the control of stockpiles and maximum information on stock levels, including private industrial stocks. And finally, she wants an investigation into the ways in which the London Metal Exchange is creating instability [*sic*].

Now perhaps all these allegations do not amount to very much—certainly not to a comprehensive programme for the industry. But the fact is that neither the United States nor the United Kingdom at present belongs to the International Trade Commission and these allegations may, for that reason, go largely unchallenged. The fact is that until the copper industry can regulate its affairs with more

adroitness than it has managed to do in the past few years, grandiose schemes on the Chilean pattern will continue to be trotted out. Nor can they easily be laughed away. They may never come to anything, but they do harm by inhibiting sensible thinking on how to achieve reasonably stable conditions in the world's mining industries. The proper way to disarm the Chileans is to produce some more sensible alternative. Alas, it is not to be found in President Eisenhower's latest brainchild!

## CHROMITE PRODUCTION IN PAKISTAN

Since 1903 nearly 800,000 tons of chromite, averaging 47 per cent chromic oxide, have been mined in Hindubagh in the Zhob district of Quetta Division, Pakistan. Unmined reserves are believed to exceed 60,000 tons. Smaller deposits have only recently been worked in the Fort Sandeman area because of transportation difficulties. In 1952 and 1953 the G.S.P. found deposits on the Ras Koh Range in the Khara district of Kalat Division, and three deposits in the Chagai district, with reserves estimated on surface evidence at 17,000 tons, with chromic oxide content of 35 to 53 per cent. The Chagai deposits are leased to Pakistan Industrial and Mining Syndicate, Quetta; and a smaller deposit, estimated at 1,000 tons, is leased to Pakistan Industries Ltd., West Wharf Road, Karachi, a large Pakistani firm with varied interests. Mining of chromite containing 47 to 53 per cent chromic oxide began in 1954.

Pakistan's chromite production over the past five years has averaged about 22,600 tons per year, well under 1 per cent of the world production. A review of statistics shows that exports from 1952 to 1955 have been somewhat under production. This is attributed to the high cost of the Pakistan product, which made it uncompetitive on the world market. The situation was improved by reducing railway freight rates and the devaluation of the rupee in 1955. Exports rose from 22,105 tons in 1955, to 34,800 tons in 1956, incorporating some of the surplus accumulated. The Rs.4,747,647 earned in foreign exchange in 1956 was partially in hard currency, as 8,600 tons went to the United States and 3,000 to Canada. The United Kingdom purchased a little more than a quarter of the total exports. The chromite is exported in lump form for metallurgical purposes; its chromic oxide content ranges from 43 to 48 per cent. A large quantity of poor-grade ore is being wasted, but Japanese buyers have shown willingness to import chromite containing only 40 per cent chromic oxide.

Before partition, chromite was mined exclusively by a British company, the Baluchistan Chrome Mines Ltd., which changed its name in 1951 to Pakistan Chrome Mines Ltd. This company and Pakistan Industries Ltd., which mine about 75 per cent of all the output, recently amalgamated their Hindubagh holdings under the name of Pakistan Chrome Mines Ltd. to market ore through their selling agents, Baluchistan Chrome Co., of London. Pakistan Industries Ltd. will continue to market ore in other areas independently. This company has set up a pilot plant at Karachi, which in its experimental stage consumed about 5 tons of ore per day. The same company is constructing a dichromate plant with a capacity of about two tons per day to go into production under the management of an affiliate, Industrial Chemicals Ltd., Karachi. K.B.H.M. Habibullah Co., Karachi, mines 3,000 to 5,000 tons annually, about 15 per cent of the total chromite production, and the remainder comes from a number of small workings.

About 75 per cent of the chromite production in Pakistan is by underground mining, the remainder being won by opencast working. The difficulties experienced in the mining industry in general have been emphasized in the

chromite mines, where even the large exporters have been unable to get licences to import simple equipment. The roads are washed out periodically by snowfalls from December to March, and production decreased from 28,400 tons in 1955 to 22,756 tons in 1956 because of the unprecedented heavy rains in the summer. In this area the tribal chiefs are responsible for law and order within their boundaries, a custom inherited from the British, and they are in a position to exclude imported labour. All work must be given to the local tribesmen through a contractor, but road construction and fruit-picking are preferred to mining, also planting and harvesting intervene. Unusual labour trouble occurred last year when the tribesmen lodged what the managers say were bogus complaints in the Frontiers Crime Court. They withdrew their claims when the mines threatened to close, but much time had been lost, and in August it was predicted that production for 1957 would be down to 20,000 tons or less.

Production of the amalgamated Pakistan Chrome Mines Ltd. was expected to be 13,000 tons in 1957. Barring new misfortunes, the company hopes to produce 24,000 tons in 1958.

Chromite production could be greatly increased if producers were able to import the necessary equipment, could offer inducements to create a stable labour force, and were serviced by all-weather roads. Beneficiating the low-grade chrome ore would increase production and reserves.

## CHANGING TECHNIQUES IN STEEL PRODUCTION

Statistical documentation of the steel industry, its record of past progress in production and distribution and its approved plans for further expansion have reached a point of over-saturation. The details of the achievements of the industry have become almost too comprehensive for the average mind to absorb, and most men will be content with the assurance that British manufacturers can still claim to make cheaper and better steel than their competitors overseas.

The outstanding merit of the latest issue of *Steel Review*, the official publication of the British Iron and Steel Federation, is that it presents in pictorial form the whole of the varied processes of iron and steel manufacture with a minimum of explanatory detail.

Two special points of interest emerge: one relating to the vexed question of the expansion of ore supplies to meet the growing needs of expansion, and the second dealing with the probable lines of future technical development.

It may surprise many to learn that no other steel industry in the world has yet had to deal with such low-grade ores as are successfully handled by United Steel's Appleby Frodingham plant. The iron ore deposits of the Humber Severn belt are enormous in their extent but they have a very low iron content.

These ores are prepared for blast furnace use by sintering carried out with great efficiency and the industry, which has already stepped up the extraction of home ores from 12,000,000 tons in 1946 to 17,000,000 tons in 1957, plans to raise this annual rate to 22,000,000 tons in 1962. The forecast is that in that year the foreign requirement will be approximately equal in terms of aggregate tonnage but with respective average iron contents of 27 and 58 per cent it will be seen that the shift towards reliance on imported ores is becoming very pronounced.

Purchase of these supplies, and, indeed, the import of all foreign materials—iron and manganese ore, pig iron, scrap and marginal tonnages of steel semis—is centrally undertaken by two companies, the British Iron and Steel Corporation Ltd. and its subsidiary, B.I.S.C. (Ore) Ltd., whose neces-

sarily vast commercial operations are cited as "the result of constant evolution and experiment in the development of a pattern of organization that would combine public responsibility with private commercial direction and control".

"In British industry", says the *Steel Review*, "and in the world of steel this pyramid is unique—and uniquely effective".

In a commentary on steel-making techniques it is stated that the British steel industry, like the American, is based primarily on the open hearth process: 85 per cent of its steel is made in open hearth furnaces, and until recently almost the whole of the post-war expansion of steel capacity in the U.K. has been of this type.

At three different plants—Corby, Ebbw Vale and Workington—limited use has been made of the Bessemer processes of pneumatic steel-making, but the total combined output amounts to no more than 6 per cent of the national ingot output. Many experts believe, however, that the potentialities of the use of oxygen in the open hearth and pneumatic steel-making processes have, as yet, hardly been touched. In various converter processes and in new ovens, designed especially for its use, it is greatly extending the range of quality that can be produced, offering steel without the limitations that are inherent in "Thomas" steel today.

In the smelting of iron also new processes, such as chemical separation and the Cyclo steel technique, developed by the British Iron and Steel Research Association, are being discussed and it is suggested that these might lead to the supply of a cheap, and comparatively pure melting base for electric steel production.

Both steel's own techniques and its future market are influenced by the rapid advance of technology in other fields of engineering such as automation and nuclear energy. Steel prepares to meet the challenge of the new age. The Federation believes that continued economic progress in Britain, as in Europe, means inevitably that steel consumption must rise, and it is in this confident belief that British steel is planning for a further high rate of expansion in a world of growing, and freer, international trade.

## N.C.B. DEFICIT

The report and accounts of the British National Coal Board covering last year's operations, to be published next month, are expected to show a loss for the year of approximately £5,000,000. This would bring the cumulative deficit since nationalization in 1947 to nearly £29,000,000.

The Board had a surplus of £8,800,000 in the first quarter of 1957 but this was more than wiped out by successive deficits of £7,620,000 and £8,150,000 in the following two quarters. It is believed that a surplus of £2,000,000 resulted from the last three months of working. Coming up to the present, the total coal output in the first sixteen weeks of 1958 is 70,500,000 tons; almost 3,500,000 tons below the figure obtaining at this time last year. However, this year has so far been relatively free of the frenzied appeals for higher production—so long a regular feature of the British daily newspapers. Even Parliamentary admissions that output per man-year is currently below that of twenty years ago have received scant attention. Stocks of coal are still abnormally high and in an endeavour to keep these down to manageable proportions the price of house coal has been temporarily reduced by 20s. a ton.

Saturday working is to stop in the near future and this news will have been greeted with acclamation by colliery managements. Although Saturday working has in previous years produced some 12,000,000 tons annually, the cost has been high and doubtless the Board can now expect some financial relief by abandoning large-scale overtime.



**U**P until the present decade very little had been done in the way of surveying in the Dominican Republic, but in the last few years an almost complete picture of the country's resources has been compiled, and several foreign and native companies are at work. Mineral exploitation, although a late starter, comes at a logical time in the country's economic programme so that it can develop rapidly and freely. The groundwork of providing 3,000 miles of excellent roads, eight new deep-water harbours and the encouragement of new manufacturing industries has been securely laid by the Trujillo Government. With a favourable trade balance of £14,900,000 in 1957 and a sound and well diversified agricultural programme, there is no problem of being unable to afford mining equipment, and in addition there is an extremely healthy climate for overseas investment.

The figures for mineral exports at the moment, therefore, only represent the early days of the industry. From the 1951 total of 144,000 tons valued at \$1,500,000, shipments rose to 280,000 tons worth \$3,500,000 in 1956 (2.5 per cent

## Mineral Wealth of the Dominican Republic

of total exports). The minerals included iron ore, gypsum, salt, marble and granite but did not include what may prove to be the most valuable deposits—bauxite, oil and nickel—which have only just started production.

Mining companies in the Republic have the physical advantages of good ports (the government is engaged in enlarging the port Enriquillo for bauxite export), short distances between deposits and coast, good roads, and in the Dominicans, very willing and intelligent workers.

Overseas companies engaged in mining in the Republic enjoy the following exemptions. There is no tax for new companies for the first five years, followed by a sliding scale of taxation to a maximum of 30 per cent of the net profit. Machinery and essential workers may be freely brought into the country. Since the Republic has a free convertible currency at par with the U.S. dollar, foreign companies can transfer profits outside the country without difficulty. Perhaps the greatest single factor in the investment scene is the country's political stability, which is unique in the area.

A typical case history of a foreign firm and its cordial relations with the Dominican Government is provided by the Alcoa Exploration Co. Under the agreement between Alcoa and the government, which runs for fifty years, Alcoa will spend \$10,000,000 to develop large bauxite deposits.

The main deposits are at Las Mercedes and Aceitillar in the province of Barahona. There is an estimated 60,000,000 tons of bauxite with an estimated aluminium content of 45-50 per cent. Throughout this period the company will be exempt from all taxes and duties except for a 38 per cent income tax and payment of 25 c. for each ton of bauxite sold. The government will co-operate in converting Enriquillo into a deep-water port for shipping the ore and will also buy 850,000 tons of ore a year for an aluminium reduction plant which is to be built. The company has ordered what is described as the largest dump truck in the world for use in the Republic from Mack Co. It will have a capacity of 37½ cu. yds. and weigh 27 tons.

The largest overseas investor is Falconbridge Nickel, which is to spend \$70,000,000 on nickel mining in the western area of the country. Production has not yet commenced. The iron ore deposits in Sanchez Ramirez, a central province, began to be exploited in 1953 by the Compañia de Minerales C. por A., a native company with government backing. The ore, which has a 67.5 per cent iron ore content, is shipped to the United States and Belgium. Production figures for iron ore are as follows:

1953	90,216 l.tons	\$1,404,847
1956	161,695 l.tons	\$2,392,865

The Republic possesses the largest solid salt deposit in the world. It stretches for a total distance of ten miles in the northern province of Barahona and contains an estimated 500,000,000 tons of salt and gypsum. The firm of Sal y Yeso C. por A. is developing the salt and gypsum deposits. Salt production has risen from 9,768 tons in 1936 to 67,407 tons in 1956. Exports of salt, previously about 50,000 tons annually, will rise now that a \$1,000,000 salt refinery has been installed by the company. Gypsum is also a valuable export material: production has increased six-fold since 1947 to 78,447 tons in 1956. Besides exporting nearly 30,000 tons in the latter year, mainly to Puerto Rico, a large quantity was also exported in the form of cement. It is expected that these figures will be considerably improved on, while the deposits are practically unlimited.

The marble quarrying industry, Marmoleria Nacional, has had considerable fluctuations in production but has now begun to export marble on a large scale at Villa Ramfis and Canoa and is equipped with the latest quarrying machinery developed in Italy. A variety of decorative building stone includes travertine, onyx and several sorts of granite.

The latest mineral exploration has been initiated by Petrolera Dominicana with a capital of \$3,000,000. This corporation, formed by Texas oil companies and local investors, has undertaken the exploitation of petroleum and other hydro-carbons. Drilling commenced last November in the valleys of La Vega, Azua and Enriquillo in the south, and at Villa Isabel in the north. At least one strike has been made at Higuerito in Azua Province and all indications point to the commencement of oil exports in the near future.

The mineral wealth of the Republic will be making a steadily growing contribution to her trade. In the same way that the country's agriculture is geared so that one crop is not relied on for foreign earnings, mining, whether by overseas or native companies, will help to give the economy the added strength of variety, as well as new processing industries.

The Dominican Republic Department of Development announces that it is prepared to extend concessions offered to private firms carrying out mineral exploitation to the new province and development area of Pedernales. Concessions include tax reductions and the duty-free import of machinery. The government plans considerable road development to open out the south-east region and connect it to the ports of Enriquillo and Barahona.



# Some Experiments in Gravity Concentration

THREE years ago, coming to Cornwall on holiday, I had the happy inspiration to write to Col. Whitworth and ask if I might be shown something of the work of the Camborne School of Metalliferous Mining. It is to Col. Whitworth's kindly response, and the resulting contacts, that I owe my present research on mineral dressing.

Mr. G. H. Jones took me in hand. His method of treatment was to ring up South Crofty and Geevor and arrange visits. When we stood in the mill, and the processes were explained, it seemed to me that perhaps I did know a little about the problems from previous experience in my research on reflecting microscopes, and ideas for research began to come even during those first visits. They led to three pieces of apparatus—a packed-column classifier, a mechanized vanning shovel, and a shaken helicoid concentrator.

In the reflecting microscope research, I had made mirrors out of speculum metal, ground to shape with carborundum in water, and I had thus accumulated a quantity of peculiar ore pulp, in which the heavy mineral was speculum metal debris—density about 8; and the light gangue carborundum, density 3.2. I had sized this ore batch-fashion in a conical elutriator—not, indeed for economic reasons, but just to attain some mastery of the sizing process. And I had noticed that by elutriating twice, at different pulp densities, one could make a partial separation of mineral from gangue, and by repeating the process one could produce pure speculum powder, or nearly pure carborundum. The densities 8 and 3.2 of the mineral and gangue are not very far removed from those of cassiterite and quartz—7.0 and 2.67, and it seemed reasonable to regard the two gravity separations as comparable.

The next line of research was obvious enough. If I became personally skilled at using a vanning shovel, I should stand a much better chance of understanding the physical factors involved in making a gravity separation, since the physical factors involved are, broadly speaking, the same as those operative in a shaking table and a vanner and a round frame. It was also clear that I must arrange to mechanize the process, since, however skilled I became, I could not count on being able to make reliable vanning assays by hand when overtired. Here, then, was a second line of research—the mechanized vanning shovel.

The idea underlying the third line—shaken helicoids—also stems from my first visits to Crofty and Geevor. While we were watching the round frames, it was explained to me how the mineral travels down the deck more slowly than the gangue, because the gangue particle, being larger, projects further into the fast-moving upper layers. As I pictured the part played in the separation by this difference in forward velocity with height, I reflected that if the unit could be so arranged that the velocity differed with height not merely in amplitude but also in direction, then one could have a separator working continuously rather than cyclically.

This could be achieved by using the secondary circulation associated with flow of fluid round a bend—the inward motion of the slowly-moving lower layers, and the outward motion of the upper layers under the stronger centrifugal force associated with their faster curved motion. This is the *modus operandi* of the Humphreys spiral, then unknown to me.

If it is desired to use an effect such as the secondary circulation, it is reasonable to start by making the bend very

*This article is based on a lecture to the Cornish Institute of Engineers by C. R. Burch, F.R.S.*

sharp (since the alternative, to increase the velocities, would give turbulent mixing). I therefore envisaged a helical channel, possibly of many turns, having a larger outer radius and a very small inner radius.

## Packed Column Classifiers

How should a classifier be designed? We wish to divide the pulp into two fractions, separated as sharply as possible according to the speed with which the grains settle in the suspension. We should like, therefore, a uniformly rising current of water in the separating column, and the column should presumably be fairly long, so that in spite of possible unwanted effects at the ends, there should be adequate opportunity for differences in settling rate to exert their effect. Further, we should like the classifier to sink small grains of heavy mineral at the same rate as very large grains of light gangue. We wish it, in fact, to have as large a hindered settling ratio as possible, because the fractions will then separate easily on shaking tables. The suspension in the separating column should therefore be as dense as possible.

Let me emphasize that the uniformly rising flow pattern in a long column may be *intrinsically* unstable; that each and every part of the flow pattern may be unstable, quite apart from trouble due to friction at the column walls. If this is so, there must inevitably be some kind of regular or irregular secondary circulation, mixing liquid at different heights. What we desire to cut out is the possibility of long-range vertical mixing, which will upset the separation. I therefore suggest that the correct approach is to subdivide the long separating column by a multiplicity of suitably perforated plates or baffles, so that there is a well-defined secondary circulation in each individual column element, between successive baffles.

The problem now is how to design the perforated plates with which the column is packed. Presumably every part of the plate should slope as steeply as possible—at 50 deg. or even 60 deg.—to avoid banking of the dense suspension on it, and it should promote horizontal mixing and retard vertical mixing. The solution which we favour (for parallel columns) is a honeycomb-lattice star-punched plate.

When the column tapers, a different type of packing may be better—one in which the sloping portions point predominantly downwards and inwards. We have devised two kinds of spiral packing which have this property, and these may be preferable to star-punched packing for tapered columns.

As you all know, when a layer of pulp is subjected to repeated reversals of shear—as when a table, plaque or shovel is shaken in its own plane—the phenomenon of reverse classification may occur; that is, the larger particles may migrate preferentially to the upper layers and the smaller to the lower layers. The textbook explanation is that this is due to consolidation trickling—that during

the periods when the shear is least, partial or complete consolidation of the pulp bed occurs, and during this process the small particles can get down in the interstices between the large ones, but the large ones cannot get down in the interstices between the small ones.

This may occur, but it is certainly not the whole story. Reverse classification still occurs when a circular orbital shake is used, and then there is never a consolidatory phase and the shear, though it varies in direction, never has a minimum value. Clearly, we have to consider why the larger particles should rise preferentially. If there were not gravity, and hence no consolidation trickling, would they still migrate away from the plaque surface? I thought that they would; that there were forces tending to drive the larger particles preferentially towards the zone of low shear.

It has been found (Bagnold, R. A., *Proc. Roy. Soc. Series A*, vol. 225, p. 49, 1954) that the pressure developed perpendicular to the shear plane is proportional to the square of the particle size and the square of the shear rate when the shear rate (radians/sec. at which a small square is being sheared trapezoidal) is large: it is also then independent of fluid viscosity. In this connection inertia is the controlling factor. When the shear rate is small the pressure ceases to depend on particle size, and becomes proportional to the modulus of shear rate and to the viscosity. (Large and small relate here to the size of the pure number (particle dia.)<sup>3</sup> x shear rate — kinematic viscosity.) There are also factors relating to the particle concentration.

When we shake a pulp bed, we propagate a horizontal shear wave upwards through the bed, so producing across any horizontal plane a Bagnold pressure. Since we shall have a vertical gradient of horizontal shear rate, we shall have a vertical gradient of Bagnold pressure, i.e., a Bagnold force field.

#### Mechanized Vanning Shovel

Thinking in terms of Bagnold forces led me to the present design of mechanized vanning shovel. A circular plaque is carried on a shaft which is slowly rotated. The bearing axis can be tilted away from the vertical. The bearing is mounted on a double parallelogram linkage, so that it can move freely in horizontal or independently tilted plane, and it is shaken in this plane with the geometric sum of two circular orbital shakes.

The slower of these shakes is adjusted to be fairly near the swash frequency of a wave travelling circularly round the plaque. This shake therefore determines principally the swirl that builds up in the plaque, and hence the strength

of the secondary circulation and the rising currents near the centre of the plaque. The second shake, of much smaller amplitude, contributes a fairly large shear gradient—and hence Bagnold force—without contributing much to the swirl and the consequent rising current. By suitably proportioning the two shakes, one can hope to make the total lifting force relatively independent of particle dia. and hence make the separation more dependent on density. Since the plaque is tilted and its shaft is rotating, particles that are relatively immobile with respect to the plaque under the given conditions must accumulate near the centre of the plaque, while the lighter particles tend to run near the edge, where one can pipette them off.

We have used this mechanized vanning shovel as our physical assay device, letting it run unattended and pipetting the gangue at intervals; resetting the shake, speed and tilt controls as the pulp patch is reduced in size, until ultimately only heavy mineral remains. It seems to be possible to make a 95 per cent—possibly 99 per cent—extraction of wolframite from the slimes we are concerned with, if one can judge by the small further recovery which systematic re-running of the gangue fractions gives. The device will make some separations (especially on slimes) that I cannot make by hand; on coarse fractions hand-vanning is sometimes quicker.

#### Shaken Helicoids

I started by making a 2-turn helicoid—5½ in. o.d., ¼ in. i.d., ½ in. pitch—out of the bases of two tins, suitably cut and brazed together, and a small centrifugal pump to circulate a few ounces of tin slime round it. In operation the long banks built up on the helicoid surface so that shaking seemed essential. I now argued—if we disregard the fact that the device is a helicoid and treat it as a flat deck shaken in its own plane, we should get Bagnold forces which might lift the large particles preferentially, but since it is a helicoid there would also be rising currents which would lift the small particles preferentially. By proportioning these effects correctly we could have particles of two different sizes lifted to the same extent and a range of sizes lifted to approximately the same extent, so that in this size range we shall get a separation depending not on size but on density.

I therefore decided to experiment with shaken helicoids. Shaken helicoids of varying pitch were then constructed with dia. up to 12 in.

At this point I was introduced to Mr. A. E. Janes, of Tin and Associated Minerals, Nigeria, and we discussed the work. The University of Bristol used a donation by



The mechanized vanning shovel. The material on the plaque is a shaken helicoid concentrate from a Hawkswood wolfram tailing fraction. The very dark inner head is wolfram plus arsenopyrite. The rather less dark, broader part is pyrite-zircon-garnet-tourmaline, etc. The white outer part is mica-feldspar-quartz, etc.

Mr. Janes to create a research studentship, to which Mr. R. H. Mozley was elected in September, 1955.

Although we still knew very little about the optimum running conditions or size ranges for which these helicoids were suitable, it seemed wise, while in Camborne, to avail ourselves of permission to make a brief trial in South Crofty. The inner fraction ran about four times richer in tin than the outer one and the recovery was not very high.

### The Hawkswood Trials

Further trials were made at Hawkswood, by courtesy of the Hawkswood Mining Co. Ltd. In the Hawkswood wolfram slime there are substantially no locked grains: the whole of the mineral is free in fine slime sizes, and indeed vanned tailings have given "WO<sub>3</sub>-trace" or "WO<sub>3</sub>-none" on chemical assay. On the other hand, in the Crofty tin slime an appreciable part of the tin is locked to gangue. Furthermore, the Crofty ore contains a great deal of limonite, which tends to flocculate; the Hawkswood ore is free from limonite and also very much less corrosive, and the Hawkswood tailing carries richer values.

Trials with pond slime on either 12 in. helicoid showed that an outer fraction carrying  $\frac{1}{2}$  to  $\frac{1}{3}$  the gangue could be rejected, carrying with it only mineral markedly finer than the main part of the mineral in the slime. The rejection of the fine part of the gangue should also improve the table performance by reducing pulp viscosity. There was a case, then, for interposing a shaken helicoid in the feed to the slime table.

The slime table first-concentrate normally carries about 10 per cent WO<sub>3</sub>. The practice has been to work this up by re-tabling. We classified a quantity of it in a packed column classifier, batch-fashion, into five size ranges, and then asked them to feed these to the table. Surprise was expressed at the clean separation which resulted.

The Hawkswood slime pond contained about 200 tons of slime, estimated to average  $\frac{1}{2}$  per cent WO<sub>3</sub>, and it was suggested that we should try to process this with helicoids. Circulating experiments in the laboratory showed that a 6-turn 12 in. dia. helicoid gave the best concentration, when shaken in a retrograde circular orbit of 1-1 $\frac{1}{2}$  mm. radius at 1,000 r.p.m. This helicoid, with a small Pelton wheel to shake it, was therefore transferred to Hawkswood and set up out of doors near the drained pond. Raw slimes in the form of a moist clayey sand containing sticks and leaves was shovelled to a sand feeder where a line of "rain" swept rhythmically over it by a water-operated rocking mechanism, washed it on to four fixed screens—8 m., 10 m., 14 m. and 16 m.—and on to the helicoid. The screens required clearing once or twice an hour. The feed rate varied from about 1 cwt. to 1 ton per 24 hours, according to the consistency and leaf content of the slime. The feed composition contained of the order of 1 $\frac{1}{2}$  per cent vannable heavy material.

Four fractions were made:

- No. 1—inner—4.5 per cent vannable heavies stockpiled.
- No. 2—2 per cent vannable heavies stockpiled.
- No. 3—dumped on pond bank.
- No. 4—to waste.

The recovery in No. 1 fraction plus No. 2 was about half the total mineral in a third of the total gangue. By re-passing No. 1 an inner fraction containing 10 per cent of heavies was made, and by classifying with a packed-column injector classifier and re-passing we obtained an inner fraction with 24 per cent heavies.

This was not a high recovery slime operation, nor one of high concentration, but the No. 1 and No. 2 fractions were

free of relatively fine sand sizes and should be worth tabling.

At this point Mr. Mozley decided that the right way to make shaken helicoids was not in sheet metal but by moulding in resin-bonded Fibreglass. Deciding further that these should be of larger pitch (2 in.), he made first a 12 in. dia. helicoid of 3 turns and then one of 36 in. dia. of 3 turns. Both these helicoids behave better than any of the metal ones. The 12-in. one was transferred to Hawkswood and used to work up some of the classified No. 1 and No. 2 fractions from the metal helicoid. Concentrate containing 84 per cent vannable heavy mineral has been obtained.

On a low-grade classifier product from No. 2 (metal helicoid) fraction, fed to the 12-in. fibreglass helicoid at 0.31 ton/24 hr., with a prograde shake of roughly 1,000 r.p.m., 2 mm. radius, we obtained with a feed of 0.83 per cent heavies:

No. 1 fraction	5.36	p.c. heavies; recovery of heavies	35.7 p.c.
No. 2 fraction	1.16	p.c. heavies; recovery of heavies	30.6 p.c.
No. 3 fraction	0.293	p.c. heavies; recovery of heavies	20.7 p.c.
No. 4 fraction	0.78	p.c. heavies; recovery of heavies	12.8 p.c.

Consider an assembly of 12 such helicoids, arranged in two rings of six, one above the other, on a common frame, with a central shake shaft. It would require possibly 100 watt shake power and should give the above-mentioned recoveries when fed with 3.8 tons/24 hr. of this slime. The equipment would occupy 4 ft. sq. of mill floor space. This compares favourably with the performance to be expected of a standard slime table on the same feed. Therefore I submit that there is a *prima facie* case for the manufacture of a "mine-size" unit with a view to commercial development.

Proposals for the manufacture of moulded Fibreglass shaken helicoids in units capable of treating 3-6 tons/day of very fine slime have been put forward by the firm of Knapp and Bates Ltd. The patent rights have been presented to Mr. A. E. Janes.

## The War Against Rust

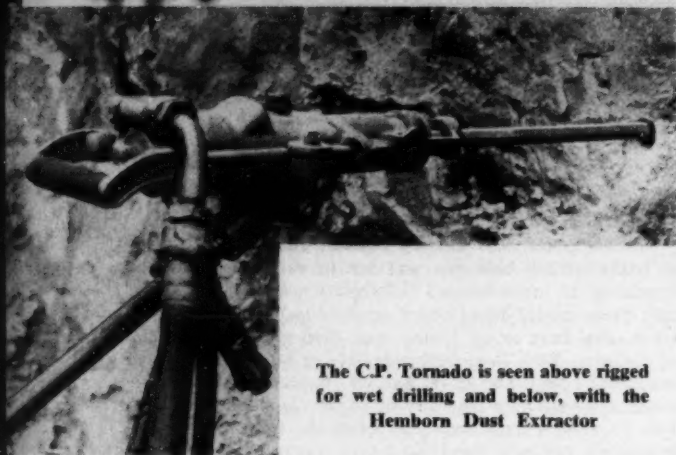
**R**UST costs Britain £2,000,000 a year, and a recent colour film featuring Rustodian, a rust-inhibiting calcium plumbate paint, initially shows the effects of the damage. The film and the product it describes are of marked interest, as this is probably the only rust-resistant paint pigment developed in any country since the war.

An animated diagrammatic sequence is used to explain in simple terms the theory of the electrical origins of corrosion. The film shows how a calcium plumbate pigmented paint inhibits rust more successfully than any other—and how it forms a protective layer over the cathodic as well as the anodic areas which exist in any piece of steel.

The film shows how calcium plumbate pigment was thoroughly evaluated and how Associated Lead—who had sponsored the research—put it into commercial production and marketed it under the trade name of Caldiox. Some of the processes of manufacture are shown.

The film then shows the manufacture of Rustodian using Caldiox pigment, and stresses the qualities of adhesion of the paint which have made it an invaluable primer for most metals and—most important of all—for new, unetched galvanizing. A series of shots illustrate that here is a primer with almost universal application. Wide application is reported in the British Isles.





The C.P. Tornado is seen above rigged for wet drilling and below, with the Hemborn Dust Extractor

**I**N recent years there has been a considerable amount of study on the part of rock drill manufacturers to produce still more powerful machines for faster tunnel driving. This development work has been taking place with the hand-held type of drill used with a pneumatic support leg, the main problems being to secure the required power and speed without excessive weight for the operator to handle or excessive wear to cause heavy maintenance.

It is in these respects that a new Tornado Tunnel Drill will engage the greatest interest, as the design has provided a machine combining the easy handleability of a medium-weight sinker with the great power and speed of a column-mounted drifter, and months of trial with prototype

A new rock drill, claimed as the fastest 50-lb. tunnel drill in the world, has just been introduced by the Consolidated Pneumatic Tool Co. Ltd., to meet the demand for a powerful machine within a weight limit of 50 lb. This new tool, known as the Tornado No. 503 Tunnel Drill, was demonstrated to the Technical Press last week at Cloud Hill quarry, Breedon, Derbyshire.

Emergency blowing can, therefore, be carried out while the drill is still running and the change over from wet to blowing can be carried out by a flick of the valve. This feature is particularly useful, as a short duration blast of air can be obtained at any time when drilling wet, thereby facilitating the cleaning of the hole.

The patented retainer is designed round a bonded rubber ring which makes assembly and operation simple and provides an excellent cushion in the event of the steel collar striking the retainer, thus reducing the incidence of breakage.

Fast drilling is, of course, a relative term. Drilling tests at Breedon showed the performance of the standard CP32F rock drill, a type equal to a normal 50-lb. class machine, in comparison with the new Tornado 50-lb. class unit operating under identical conditions.

Compressed air at 90-lb. working pressure was supplied from a Model 365-RO-2 Power Vane Rotary Compressor

## Rapid Drilling in Rock

machines have proved that the rate of wear is no greater than conventional tools of lesser performance. The Tornado, entirely British designed and British built, obtains a high power weight ratio achieved by the use of a short stroke, coupled with a large diameter piston. The piston design is such that the maximum area is exposed to the air pressure in the cylinder and the mass of the piston ensures that high acceleration is obtained with good energy transfer.

The air flow passages through the valve are arranged to minimize the pressure drop, thereby ensuring that maximum pressure is available to the cylinder to do work on the piston. In addition, the valve case cover is shaped to provide immediate acceleration of the piston and good air cushioning at the end of the upstroke. Furthermore, the valve is designed so that ample cushioning is provided at both ends of the stroke. The position of the valve trigger ports in the cylinder are arranged so that "freezing" conditions will not affect the action of the machine.

An easy quick-to-operate three-position valve is fitted in the backhead of the machine which allows the selection of (a) Water; (b) Emergency blowing air; the third being an off-position.

### TORNADO NO. 503 COMPARISON DRILLING TESTS

Machine	Rods (in. hex.)	Hole Dia. (in.)	Depth (in.)	Time	Penetration (in. per min.)
CP32F*	$\frac{1}{2}$	$1\frac{1}{8}$	26.5	1 min. 15 sec.	21 $\frac{1}{2}$
CP32F	$\frac{1}{2}$	$1\frac{1}{8}$	21 $\frac{1}{2}$	1 min.	21 $\frac{1}{2}$
503	$\frac{1}{2}$	$1\frac{1}{8}$	26 $\frac{1}{2}$	37.5 sec.	42 $\frac{1}{2}$
503	$\frac{1}{2}$	$1\frac{1}{8}$	48	1 min. 16 sec.	37 4/5

\* Using Hemborn Dust Extractor. All other tests "wet" drilled.

and a 1 in. air hose was employed in both tests. Rock at Breedon is a hard limestone having an average crushing strength of over 29,000 lb. sq. in. Both drills were fitted with SECO tungsten carbide-tipped stems of  $\frac{1}{4}$  in. dia. and the machines were mounted on a standard CP 4-ft. Feedleg. A further trial was carried out using the Hemborn Dust Extractor for dustless dry drilling.

It was clear from all these tests that the new Tornado Tunnel Drill is a machine of great power and speed.





## THE MECHANICAL HANDLING EXHIBITION, 1958

The Mechanical Handling Exhibition being held at Earls Court from May 7 to May 17 will provide a shop-window for British and foreign exhibits in the field of mechanical handling. A wide range of equipments will be displayed, many of which are of interest to the mining industry.

**Rubber Improvement Ltd.**, in addition to being the largest contractors of P.V.C. conveyor belting to the National Coal Board, also supply hundreds of thousands of feet of R.I.L. belting to mines, quarries, and industrial users throughout the world. On Stand 205, the company is exhibiting several conveyor beltings.

**Rilflex** conveyor belting, fully approved by the National Coal Board, is a new and revolutionary development in the field of P.V.C. multi-ply anti-static fire-resistant conveyor belting. It is regarded by mining engineers as a major step forward not only in the field of mining safety techniques but in the sphere of mechanical handling, where it can be applied to advantage in many different fields both above and below ground. **Leonex** and **Rilon Green-for-Safety** P.V.C. multi-ply conveyor beltings are also displayed. Millions of feet of these types of belting are installed in mines and quarries.

Other products being shown include **Rilite** corrugated glass-fibre roofing and **Vanlite** commercial vehicle roof and body panels.

On Stand 72, **Fisher and Ludlow Ltd.** are displaying **Flexiroll** troughing idlers. Engineers concerned with the manifold problems of conveying coal, ore, and other granular materials will welcome the introduction of this system. First cost is substantially less than for conventional systems, and in addition there are many

outstanding technical features, some of which are: no maintenance, as the nylon bearings do not require lubrication; no fire risk, as there is no metal-to-metal contact, entirely eliminating this frequent source of risk; **Flexiroll** shapes itself to the load; prolongs belt life—cushions and guards the belt; and resists corrosion, abrasion, and flame. **Flexiroll** is presented as being particularly suitable for moving coal underground.

Other equipments shown by these manufacturers include the **Flowline** overhead chain conveyor with towing trucks, the **Flowline** roller top conveyor, the **Flowporter** belt conveyor system, and various pallets.

**Steels Engineering Products Ltd.**, who design, manufacture, and market **Coles** cranes, announce the introduction of an entirely new range of fifteen cranes. Ranging in capacity from 6 to 45 tons, the machines are of three types: self-propelled, truck-mounted, and shunting loco cranes. Four of the new range and two existing models are exhibited at the exhibition in May.

They are the **S510**, a fully mobile, self-propelled, diesel-electric crane with a lifting capacity of 6 tons at 7 ft. radius with 25 ft. centres cantilever jib; the **S1510**, a self-propelled, diesel-electric, fully mobile crane with a full-circle slewing superstructure, will lift 12½ tons at 10 ft. radius with 30 ft. strut jib; the **L3010**, a truck-mounted, diesel-electric, heavy-duty crane with a lifting capacity of 25 tons at 10 ft. radius with a 30 ft. centres strut jib; and the **S5012**, a self-propelled, fully mobile, diesel-electric crane with a lifting capacity of 45 tons at 10 ft. radius with a 50 ft. centres strut jib. These equipments have never been displayed previously. Other units include the **R5010**, a heavy-duty, rail-mounted, diesel-electric shunting loco crane which will lift 45 tons at 12 ft. radius with a 50 ft. centres strut jib, and the **S1210**, a self-propelled, diesel-electric, full-circle slewing mobile crane with a lifting capacity



The Model L3010 Coles crane

city of 10 tons at 10 ft. radius with a 20 ft. centres cantilever jib.

**Metropolitan-Vickers Electrical Co. Ltd.** occupy Stand No. 240. A principal exhibit is a twin-motor hoist control system for cranes; other exhibits include squirrel-cage motors, a capacitor-start induction motor, **Perigrip** brakes, **Magistor** photo-transistor relays, the **Type TSA** circuit-breaker and control station push-buttons, selector switches, and indicating lamps.

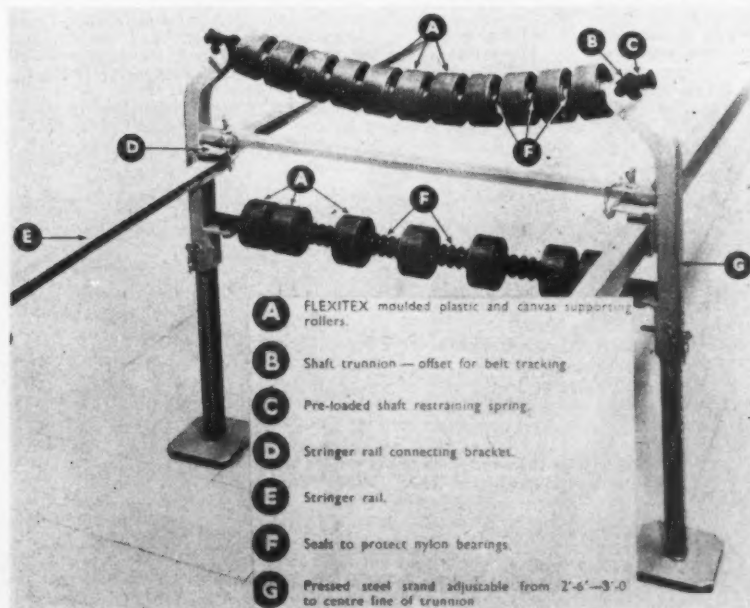
A demonstration model of an experimental **Metropolitan-Vickers** brushless spherical motor is also shown on the stand of the **Electrical Development Association**.

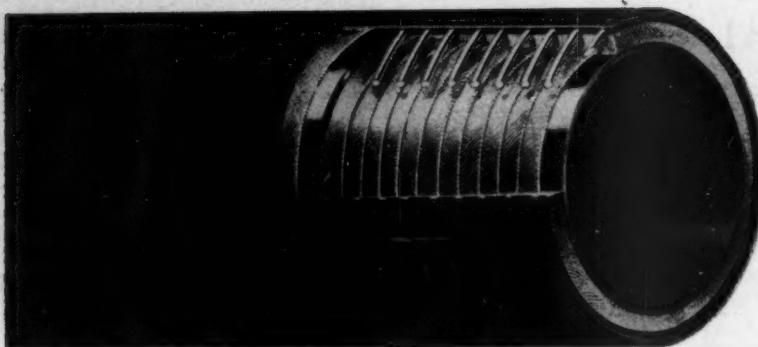
**Richard Sutcliffe Ltd.** are showing a belt conveyor fitted with an automatic hydraulically operated loop take-up. This entirely new design is being shown at the exhibition for the first time. The main application of the unit is in underground mining conveyors.

For the first time, **Goodyear Tyre and Rubber Co. (Great Britain) Ltd.** is showing **Armadillo** chute lining at this year's Mechanical Handling Exhibition. The display is on Stand 254. **Armadillo** is a tough rubber sheet form with comparable resistance to wear of **Goodyear Stacker** conveyor belting. The rubber used is compounded for maximum abrasion and can be supplied either with or without a fabric backing. It protects wherever abrasion threatens—in chutes handling bulk materials of all types; on conveyors, or as belt scrapers; also as a protective lining for shot or sand-blast chambers. **Armadillo** chute lining has outlasted steel by as much as 12 to 1.

Also on view are samples of the full range of **Goodyear** conveyor belting. A representative selection of industrial

Flexiroll hammock-type troughing idlers





hoses are shown. A special display of oil suction and discharge hoses for the oil industry is available for inspection, and on display in addition is the complete range of Goodyear's transmission belting.

On Stand 202, the Belting Division and Engineering Components Division of *Dunlop Rubber Co. Ltd.* are showing the Starwear, a new conveyor belt of cotton and synthetic fibre construction with anti-static fire-resistant cover, is among the wide range of Dunlop belts exhibited. Advantages claimed for it include increased resistance to damage from impact and tearing; reduced weight with resultant saving in power costs; and superior driving characteristics and troughing. A three-ply belt is equivalent in tensile strength to one of standard five-ply 32 oz. cotton-duck construction. It is available in either rubber or P.V.C.

Two other new belts shown are the Stargrip and Starhete. The Stargrip has a special face tread. The Starhete is a heat-resisting belt made from synthetic rubber which can be used for material of reasonable lump size up to temperatures of 300 deg. F. or even higher when the lumps are large.

A demonstration model illustrating the stopping power of industrial disc brakes is the central feature of a disc brake display elsewhere on the stand.

*C. H. Johnson (Machinery) Ltd.* exhibit on Stand No. 42. As one of the world's largest makers of portable belt conveyors, Johnsons have long been conscious of the need for a high-capacity, high-speed conveyor belt which would handle bulk material such as coal, oxide, ballast, etc., at steep angles without the need for cleats or flare-plates and eliminating costly troughed idlers. Their solution can be seen in their Corruband flanged conveyor belting, handling  $\frac{1}{4}$  in. round natural gravel at 27 deg. inclination. The belt exhibited to 24 in. wide, running at 200 ft. per min. with a capacity of 190 tons per hour.

The conveyors exhibited with Johnson's "Corruband" Belting will be powered with Johnson-Bauer drum motors. These drum motors are available in a wide range of sizes and horse-powers from 6 in. dia. x  $\frac{1}{4}$  b.h.p. to 20 in. dia. x 15 b.h.p.

Johnson Hyloband portable bulk-fed conveyor is also on display, as are Johnson dumpers and the company's Multi-brator concrete vibrator.

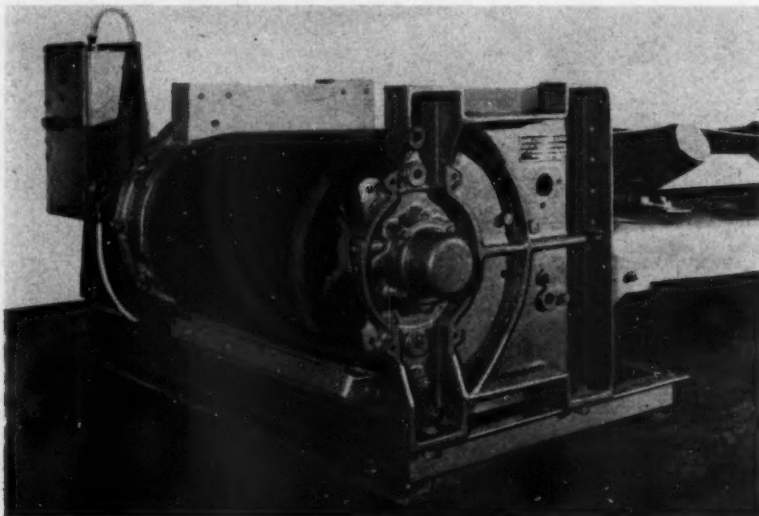
A new small driving gear for belt conveyors is one of the three sizes on the *Mavor and Coulson Ltd.* stand. This Size 25 can take 6 h.p. from the motor when the belt speed is 270 ft. per min. Each of the three sizes can be driven by any type of motor or engine. The silent

Above is an example of one of Goodyear's wide range of suction and discharge hose for industry. This is a sectioned view of the Thor Super S smooth bore for a working pressure of 250 p.s.i.



Above is a 24-in. wide Corruband belt handling  $\frac{1}{4}$ -in. rounded gravel at 27 deg.

Below is the Size 25 driving gear for belt conveyors by Mavor and Coulson



V-ropes absorb the shock of any sudden heavy load and the second-speed reduction runs in oil. The drives are self-contained and weatherproof. The two larger sizes are widely used on field conveyors as well as in permanent sites, and have been proved to have long and reliable lives. The Size 25 is exhibited at work, driving a belt conveyor which runs on a new form of sectional belt conveyor, stringer structure type 2.

Prominent among Scottish exhibitors is the *North British Rubber Co.*, with a comprehensive display of conveyor belting (rubber and P.V.C.), hose, and timing belts.

A new fire-resistant conveyor belt, the first ever to be specially designed for carrying loads on steep gradients, has just been developed by *BTR Industries Ltd.*, and is shown for the first time on the company's stand (No. 222). This new anti-load slip belt, which has specially compounded covers enabling it to carry run-of-mine coal up or down gradients in excess of 1 in 3, is one of the Pluvicor series of BTR conveyor belts.

Also shown for the first time at the exhibition is the BTR high-test V-belt in "grommet" construction and the range of BTR high-cap V-belts with genuine premium h.p. ratings.

On Stand 331, *Cable Belt Ltd.* have on display a working model of a Cable Belt rope-driven conveyor.

On Stand 110, *Merton Engineering Co. Ltd.* are showing the two-way loader, the only hydraulic overloader with variable discharge heights at both front and rear, and the Model EHD 17 ft. high discharge overloader.

Among the *English Electric Co. Ltd.* industrial motors on view are: a complete range of ventilated-type standard-dimensioned 65 deg. C. rise motors to the new B.S. Specification, Buxton certified flameproof motors for hazardous duties below ground or on the surface in explosive atmospheres, and short-time rated slipping crane motors which feature low rotor current.

*Ransomes and Rapier Ltd.* are exhibiting the Rapier 4 fast standard mobile crane and the Rapier super fork truck.

# MINING MISCELLANY

Production of chromite in India increased by 25,856 tons to 78,542 tons during 1957, according to the Indian Bureau of Mines.

An official of the Emerald Isle Mining Co. at Allihies, County Cork, has confirmed the discovery of an asbestos vein in the Allihies district.

China's gold production this year is expected to include 120,000 oz. in Shantung, 2,400 oz. in the Sinkiang-Uighur autonomous region, 11,600 oz. in Kwangtung, and 3,100 oz. in Yunnan.

The Danish Minister for Greenland has asked the Parliamentary Finance Committee for 1,000,000 kroner to finance prospecting for molybdenum this summer in the Northern Mining Co.'s East Greenland concessions.

The National Coal Board's Technical Mission to Russia has issued appendix No. 5 to its report on "The Coal Industry of the U.S.S.R.", published last year. This can be purchased from the Board's Publications Section at a cost of 3s. (3s. 6d. post free).

The World Bank has approved a loan equivalent to \$28,000,000 for the railways of Nigeria. The loan will help to finance a five-year programme to improve the rail system and build a new line into the north-eastern province.

An increase in orders for heavy mining equipment on both home and export account is reported in the U.K. by the Economic Survey Committee of the Purchasing Officers Association. Production is stated to be higher.

There is a report that a Burmese firm of coal importers is seeking government help to open the old Kyobin coal-mine, 24 miles west of Kyaikthin railway station in the Shwebo district. Government

help is required to dislodge bands of insurgents who are active in this locality.

Exports of mineral products from British Borneo last year rose in value to the record figure of 376,900,000 Malayan dollars, according to the annual report of the Borneo Geological Survey. The products included oil, gold, phosphates, bricks, lime, gravel, and tiles. The report referred to finds of chromite and manganese ore in North Borneo.

A report from New York states that as from May 4, Kennecott's Chino Mines Division has gone on to a four-day week to reduce copper production by 20 per cent. It was made known some two weeks ago that Kennecott's Western Mining Divisions were revising their schedules in a third production cut this year, that would bring output down to about 67 per cent of last year's rate.

On the recommendation of two Canadian mining engineers, Barymin Explorations and Elder Mines have jointly taken an option on a manganese project in Brazil. The property is at present being operated on a modest scale by lessees, who have been shipping approximately 700 tons monthly. The Canadian engineers report an indicated 3,300,000 tons contained to only a comparatively shallow depth.

In our issue of April 4 we stated that the Oceanic Iron Co., which is controlled by the Rio Tinto Co. of Canada, planned to spend more than \$150,000,000 to exploit medium-grade iron ore deposits in Northern Ungava. This report was based on a misunderstanding and we are informed that no definite plans have yet been announced by Oceanic Iron Ore Co. or the Rio Tinto Co.

A prospecting licence has been granted by the Eire Minister for Industry and Commerce to two County Wicklow min-

ing experts for prospecting work on lands at Glenties, County Donegal. An old silver mine exists in this area, but it has not been worked for more than a century. Surveys carried out last year by Canadian experts in the same area have not been followed up, due to the fall in the world prices for lead and zinc.

Speaking at the 25th anniversary ceremonies of the Commodity Exchange Incorporated in New York, the president, Mr. Harold S. Roussellot, noted that activity in copper futures had increased in the first quarter of 1958 compared with the first quarter of 1957. He said that the Exchange planned to embark on an aggressive drive to make better known its functions and its importance to industry both at home and abroad.

The National Stabilization Council has been informed that the Corporacion Minera de Bolivia, which controls the large nationalized mines, is faced with a deficit of \$U.S.2,000,000, which must be met by the Bolivian Government. The Council said that, to prevent the economic collapse of the Bolivian Mining Corporation, it would be necessary to obtain another loan in the U.S., or failing this, to take advantage of the offer made some time ago by the Venezuelan Government to grant Bolivia an extensive credit.

The temporary closing of the lead-zinc-copper mine in New Brunswick, Canada, operated by Heath Steele Mines Ltd., has been announced by American Metal Climax Inc. Heath Steele Mines, a 75 per cent subsidiary of American Metal Climax, started break-in operations early in 1957. Because of depressed prices, the property was never brought up to its planned capacity of 1,500 tons of ore per day.

The special Council of Ministers of the six-nation Coal and Steel Pool has shelved a plan of the High Authority to create an equalization fund to finance Europe's surplus coal stocks. At a meeting of the Council, discussion of the problem of financing excess coal stocks was adjourned until an unspecified date. Opposition to the plan for an equalization fund was understood to come chiefly from the West German and Netherlands Governments, who felt that such a fund would tend to over-protect Europe's coal mines from ordinary economic vicissitudes.

West German consumption of the main non-ferrous metals rose by 4.3 per cent in 1957, states the annual report of the Non-Ferrous Metal Industry Association. Consumption of copper, lead, nickel, tin and zinc together amounted to about 1,210,000 tons, which was about 50,000 tons more than in 1956. Consumption of copper, which increased by 25,000 tons to 470,000 tons, and of tin, which rose by 1,500 tons to 11,000 tons, showed the sharpest advances. Nickel consumption fell by 5.2 per cent to 11,000 tons.

Important changes have been made in the plans for the construction of the Polish sulphur mine at Piasczno, Rzesnow Voivodship. Instead of 750,000

Steel framework of permanent shops building (left centre) and warehouse (right) at the Thompson plant-site area of International Nickel's new nickel project in Manitoba. Housing for construction workers is shown in foreground. The Manitoba project is being developed into the world's second largest source of nickel supply with a scheduled annual output of 37,500 tons of nickel by 1961





tonnes of sulphur ore annually, the Piaseczno mine is to produce 1,900,000 tonnes. The planned quantity of pure sulphur which can be extracted is to be increased from 150,000 to 350,000 tonnes annually. The start of construction of a second sulphur mine in Machow has been fixed for two years later than had been previously planned, thus allowing investment to be concentrated to a greater extent on the Piaseczno mine. It is estimated that when both mines are fully in operation, and if the processing plant capacity is fully utilized, the output of sulphur can be doubled from 500,000 tonnes, as originally planned, to 1,000,000 tonnes annually.

### PERSONAL

Mr. Frank R. Milliken has been appointed executive vice-president of Kennecott Copper Corporation.

Ambassador E. H. van Kleffens has taken up his post as Chief Representative in the U.K. of the High Authority of the European Coal and Steel Community.

Mr. E. S. Everitt, managing director of Ruston-Bucyrus Ltd., left at the beginning of May for a visit to the U.S.A. and Canada, returning in mid-June.

Mr. Franc. R. Joubin, consulting geologist of Toronto, has been elected to the board of directors of Bralorne Mines Ltd. Bralorne is the gold mine in Canada's Bridge River district which is successfully developing very important tonnages of 1-oz. gold ore.

At the annual general meeting of the London Chamber of Commerce on May 6, Sir Edward Chadwyck-Healey, Bt., retired from the presidency, having served for the maximum period of three consecutive years, and the Rt. Hon. Lord Ebbisham was elected to succeed him.

At a general meeting of the South Wales Institute of Engineers, to be held at Cardiff on May 15, Mr. George Tomkins will be presented with the Institute Gold Medal and Certificate for the year 1957, which the Council awarded him for his paper on "Some Features of Shaft Sinking and Inset Work at Cynheidre".

The directors of Paringa Mining and Exploration Co. Ltd. announce that Dr. G. A. Schnellmann, of MacKay and Schnellmann, the company's mining consultants, is leaving for Australia to visit the company's Milo Leases in the Cloncurry district of Queensland. Diamond drilling, which started last month, had reached 271 ft. in the first hole by April 21; the prospect shaft has reached 116 ft. During the visit it is intended to arrange radiometric sampling of the hole and to plan future operations.

Mr. Clyde E. Weed, formerly president, has been elected chairman and chief executive officer of the Anaconda Co. and of its subsidiaries, Chile Copper Co., Chile Exploration Co., and Andes Copper Mining Co. He succeeds Mr. Roy H. Glover, who died on March 31. Mr. Charles M. Brinkerhoff has been elected president and a director of Anaconda and the Chilean subsidiaries. Until now, he has been executive vice-president of Chile Exploration Co. and Andes Copper Mining Co.

Mr. T. A. Rogers has been elected president of the Institution of Mining Engineers for the year 1959-60, and will succeed Mr. H. A. Longden at the 65th annual general meeting of the Institution to be held in London on January 29, 1959. He was for the two years 1950-51 and 1951-52 president of the South-Western Society of Mining Engineers and in 1955-56 president of the South Wales Institute of Engineers. He is a vice-president of the Southern Counties Institute of Mining Engineers and has been a member of Council of the Institution of Mining Engineers since 1948. He was appointed C.B.E. in the New Year's Honours List in 1956.

### COMPANY EVENTS

At the time of the Canadian Trade Mission to Britain last year, Birlec Ltd. had launched a survey of the Canadian market. The result was encouraging and the company has followed up this initial exploration by forming a branch organization in Canada to supply furnaces and other Birlec equipment to the Dominion's growing engineering and metallurgical industries. In charge of the new venture is Mr. Brin Evans, who will set up his base in Toronto early in May.

Uddeholm Ltd. (the British associate of Uddeholms AB, the large and old-established Swedish mine-owning and steel-making concern), have inaugurated a new division. Known as the Tool Division, it will be concerned with the sale and development of small tools as used in production engineering, with particular emphasis on the application of Uddia brand hard metal in tips, tools, dies, tube mandrels, sand blast nozzles, and other wear-resisting components. The division's headquarters will be at Crown Works, Northwood Street, Birmingham 3 (Telephone: Central 8971, Telex: 33/151). Mr. A. H. Mills has been appointed as manager.

The 1958 Assembly of the International Organization for Standardization—ISO—will be opened at Harrogate on June 9 by the president, Sir Roger Duncalfe.

The opening session of the Production Conference, which is to run concurrently with the Production Exhibition at Olympia, will take the form of a discussion forum on "Selling in world markets". In the chair will be Major General K. C. Appleyard, past-president of the Institution of Production Engineers and an internationally-known consultant engineer. This session commences at 3.30 p.m. on Tuesday, May 13, 1958.

## Obituary

### LEROY ATWOOD PALMER

The death occurred early in 1958 of Mr. Leroy Atwood Palmer, who for many years was correspondent of *The Mining Journal* in the United States. Born at Lockport, Will County, Illinois, in 1879, he was a consulting engineer with a distinguished record in the fields of mining and civil engineering. A former vice-chairman of the California State Mining Board, he contributed numerous articles to many mining and metallurgical journals in the United States and Britain.

## The I.M.M. Dinner

The annual dinner of the Institution of Mining and Metallurgy was held last Monday evening at Drapers' Hall, E.C.2, under the chairmanship of the president of the Institution, Mr. G. Keith Allen. The toast of the Institution was proposed by the Rt. Hon. the Earl of Home, Secretary of State for Commonwealth Relations.

Other notable guests included the Rt. Hon. Alan Lennox-Boyd, M.P., Secretary of State for the Colonies; the Rt. Hon. Sir Eric Harrison, High Commissioner for Australia; Sir Gilbert Rennie, High Commissioner for the Federation of Rhodesia and Nyasaland; Mr. J. Wesley Adams, First Secretary at the U.S. Embassy; Mr. W. Gibson-Smith, First Secretary at the Canadian Government Office; the Rt. Hon. Viscount Falmouth and Dr. R. P. Linstead, respectively chairman of the Governing Body, and Rector of Imperial College; Professor Sir Arnold Plant; Mr. C. M. Moordyk, representative in London of the South African Mines Department; Mr. H. A. Longden, president-elect of the Institution of Mining Engineers; Mr. G. L. J. Bailey, senior vice-president of the Institute of Metals; Dr. Francis H. Carr, past-president, Society of Chemical Industry; Dr. C. J. Stubblefield, president of the Geological Society; Mr. A. V. Conrad, vice-president of the British Overseas Mining Association; Mr. A. Chester Beatty, Mr. J. N. V. Duncan, Major-General Sir E. L. Spears, Mr. G. F. A. Burgess, Brigadier C. Huxley, of the Nuffield Foundation; the Rev. L. H. Waddy and Mr. R. J. Knight, respectively headmasters of Tonbridge and Oundle.

The toast of "Our Guests" was proposed by Mr. J. B. Dennison, president-elect of the Institution.

### At the I.M.M.'s Annual Meeting, May 15

The Institution's Gold Medal will be awarded to Dr. John Fairfield Thompson in recognition of his distinguished services to metallurgical science, research and practice, with special reference to the nickel industry.

Honorary membership of the Institution will be conferred on Mr. Robert Annan, Dr. Frank Dixey, and Mr. Maurice Alan Edgar Mawby.

"The Consolidated Gold Fields of South Africa Limited" Gold Medal for the session 1956-57 will be awarded jointly to Mr. Kenneth E. Mackay and Mr. John David Johnson for their paper entitled "The Development of the Bancroft Mine" (*Transactions*, vol. 66, 1956-57); and "The Consolidated Gold Fields of South Africa Limited" premium of 40 guineas to Mr. John Morison Caw for his paper entitled "Control of air pressures as an aid to fight mine fires" (*Transactions*, vol. 66, 1956-57).

The "Arthur Claudet" Students' Prize will be awarded to Dr. John Kenneth Almond for his part authorship of the paper entitled "Pulp density measurement with ultrasonics" (*Transactions*, vol. 66, 1955-56); and the "William Frecheville" Student's Prize to Dr. Barry Scott for his part authorship of the paper entitled "Stratigraphical and structural ore controls on the Slitt Vein at Heights Mine, Weardale, County Durham" (*Transactions*, vol. 66, 1955-56).



**Metals and Minerals****Progress and Prospects of the U.K. Aluminium Industry**

The stability of the overall demand from the principal aluminium-using industries in the U.K. was commented upon by Lord Portal of Hungerford, chairman of the British Aluminium Co. Ltd., at the annual general meeting of the company on May 6. Orders for road transport, hollowware and domestic equipment, electrical and general engineering purposes actually increased during the year as compared with 1956.

In the latter part of 1956, however, and throughout 1957 there was some recession in demand for aluminium products from the high level reached in 1955 and 1956, due for the most part to factors operating in varying degrees in most Western countries. In the U.K. credit and other restrictions brought about a temporary reduction in demand for consumer goods, particularly motor cars and domestic equipment, and made it necessary for manufacturers to reduce stocks of raw materials in order to meet capital and other financial commitments. The introduction of these Government restrictions coincided with the increase in supplies of virgin aluminium, so that manufacturers soon realized that they could obtain supplies on short-term delivery and no longer needed to carry stocks of raw materials to safeguard output. This fundamental change in the pattern of trade inevitably hit raw material suppliers such as British Aluminium, and had the effect of curtailing home demand to a much greater extent than actual consumption.

Demand for some fabricated forms of aluminium was, of course, influenced by the recession to a greater extent than for others, castings being quite seriously affected, while foil production remained at a high level. Consumption of a metal such as aluminium, which is firmly established in many industries, is closely related to the general industrial output of the country, which reached a plateau in the 1956-57 period, but started to increase again in the second half of 1957. Parallel with these trends, home demand for aluminium products made a healthy recovery in the latter part of 1957, indicating that manufacturers had absorbed stocks and were purchasing at a rate comparable with the level of production of the country.

On the other hand, the trend in overseas markets deteriorated considerably during the year. Competition from several sources in many overseas markets during the last year or two has reduced prices to levels which the chairman describes as quite uneconomic for any exporter. In Lord Portal's opinion, the recent price reductions will not in the long term have any beneficial effect on the progress of the industry. While reductions in price resulting from technological improvements are at all times desirable, it is pointed out that the consumer requires the greatest possible price stability for long-term planning. To be successful, an expanding industry must be able to convince the investor that it can sell its products at prices which will enable newly installed capacity to generate sufficient funds for healthy expansion.

Lord Portal considers that current prices are unrealistic in this context.

With the prospect of further substantial expansion of production of virgin aluminium in the Western world during the next five to ten years, expansion of demand to absorb the increase depends to a very large extent on the improvement of fabricating processes and the development of new bulk uses for the metal. To make this possible, British Aluminium's research, production and sales development organizations are energetically investigating new methods of casting, rolling and extruding aluminium to produce sheet and strip, sections and tubing in substantial quantities and at competitive prices for specific bulk uses such as containers and closures, building construction, and motor-car manufacture. It is considered that the inherent advantages of aluminium construction are very far from being fully exploited in many industries, even in the most highly industrialized countries.

The increase in demand through expansion of existing uses in less highly developed countries is also capable of absorbing very considerable additional tonnages.

The company has complete faith in the long-term outlook for aluminium. In this connection it is noteworthy that British Aluminium, far from spreading out its expansion programme over a longer period, has decided to bring forward by several months the completion of the second stage of its Canadian subsidiary's Baie Comeau scheme. Great hopes are entertained for the ultimate success of the Commonwealth Aluminium Corporation, in which British Aluminium is associated with Consolidated Zinc Corporation for the development of the extensive bauxite deposits in the Cape York Peninsula. Field work has continued with satisfactory results and an agreement has been completed between COMALCO and the Queensland Government. It may yet be some time before a definite programme of construction work can be formulated. Meanwhile, the exploration programme is proceeding.

Sales of aluminium products to the petroleum and chemical industries are expected to be more than trebled by 1960, according to an official of Reynolds Metals. Pipelines and offshore drilling structures of aluminium made their debut in 1956 and to date Reynolds has sold more than 500 miles of such piping to the oil industry. Aluminium has also become acceptable as a material for tanks and vessels in the chemical processing industries.

Reynolds Metal Co. has announced that production is to be curtailed by approximately 15 per cent as from May 1 at its two north-west aluminium reduction plants, and that this curtailment will continue for an indefinite period. The cuts are being made to adjust operations to present commercial requirements, which are running at a rate equal to 70 per cent of production. The company has been producing aluminium at a rate close

to its present capacity of 563,500 tons annually.

**THE U.S. MANGANESE MARKET**

Uncertainty continued to prevail last month regarding any manganese barter deal between the U.S. and India, although such a project is still being discussed. Some smaller barter deals are reported to have been concluded for ore from Africa, and it is possible that such arrangements with India may be limited to lesser agreements of this type rather than the bigger deal previously considered. In the case of those smaller agreements already set, the greater part of the ore has been of 46 or 48 per cent grade with the price a little below \$1.25 a 1-ton unit. Meanwhile, there has been practically no industrial business and sellers admit that the price level should be considered some 6 or 8 c. below the previously quoted level of \$1.33-\$1.36.

It is understood that manganese ore mined in the U.S. will be purchased by the General Services Administration through next year. The lesser of the two domestic purchase programmes has just run out. This programme has obtained manganese ore averaging around 21 per cent manganese. There is now some doubt as to whether any upgrading project will be carried out by the Government.

G.S.A. reports that its major ore-buying programme will probably not be ended until the end of 1959. This calls for buying 24,000,000 l.dry units of minimum 40 per cent Mn ore. It has a maximum of 16 per cent iron, 0.3 per cent phosphorus, and a combined 1 per cent maximum of copper, lead and zinc with the maximum copper 0.25 per cent. The maximum alumina and silica is 15 per cent. The base price is \$2.30 per 1-ton unit for the standard 48 per cent ore. From 44 to 48 per cent there is a 1 c. a unit penalty for the Mn content and from 40 to 44 per cent a 1½ c. penalty.

**QUICKSILVER IN THE U.S.**

A summary of quicksilver in 1957 has been issued by the Bureau of Mines, U.S. Department of the Interior, this survey being confined to the U.S. domestic industry and trade.

Output of quicksilver at U.S. mines in 1957 totalled 33,340 flasks, being the highest annual peacetime rate, except for 1940, in fifty years. General imports decreased without interruption from 16,761 flasks in the first quarter to 6,300 in the last quarter and totalled 45,400 flasks—about 7,000 flasks less than in 1956. Spain, Italy and Mexico supplied 90 per cent of the imports, followed by the U.K., Yugoslavia, Canada, Colombia and Peru.

Quicksilver consumption in 1957 was down about 3 per cent from 1956—52,400 flasks against 54,100 flasks. Expansions in chlorine and caustic soda plants assisted in maintaining a high level of consumption. The largest fields of usage were in electrical apparatus (8,950

flasks); agriculture—including insecticides, fungicides and bactericides (5,927 flasks); industrial and control instruments (4,630 flasks); pharmaceutical and dental preparations (1,741 and 1,193 flasks respectively).

Industrial stocks decreased by nearly 1,700 flasks in 1957 and at the end of the year totalled 20,627 flasks, of which 4,127 flasks were in producers' hands.

The price of quicksilver in the U.S. declined from \$255-\$257 a flask at the beginning of 1957 to \$225-\$230 at the end of the year and averaged \$246.98. Following a recent reduction, it currently stands at \$228-\$231.

#### ANTIMONY IN THE U.K.

The antimony ore market in London has remained steady at from 19s. 6d. to 20s. 6d. per 1-ton unit, c.i.f. Europe, for about four months. In so far as the U.K. is concerned, business is of a routine nature. There are reports that rather less Bolivian material is on offer because of some improvement in the U.S. demand.

Prices for foreign antimony metal are said to be again more or less competitive with those of U.K. domestically produced material. In other words, foreign producers have lowered their prices sufficiently to incorporate the recently imposed higher duty of 25 per cent or £40 per ton, whichever is the greater. Foreign metal entering the U.K. would currently pay £40. U.K. domestic metal prices are

£197 10s. per ton delivered for 99.6 per cent and £190 per ton delivered for 99 per cent. So far as can be ascertained, foreign antimony would have to be considerably cheaper than U.K. metal before it attracted much buying interest.

#### TURKISH CHROME EXPORTS

A report from Istanbul states that Turkish chrome exports have almost come to an end because prices offered by foreign buyers are so low that sellers would suffer a loss. Turkey's quotations for 45 per cent chrome ore are \$45-\$46, while foreign buyers offer \$25. Some 2,880 tons were exported to France recently and 1,000 will go to the U.S. in mid-May. Both deliveries are under old contracts.

#### SELENIUM DEVELOPMENT PROGRAMME

Eight North American firms, grouped as the Selenium and Tellurium Development Committee, have arranged for a programme of investigation and development by the Battelle Memorial Institute, where a number of very promising studies are already in progress. The eight firms constituting the Committee are: American Metal Climax, Anaconda, Cerro de Pasco, International Nickel, Kennecott, Noranda Mines, Phelps Dodge, and U.S. Smelting, Refining and Mining.

### COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

During the week, activity on the Metal Exchange has remained at a very moderate volume and a weaker undertone has developed in all the metals except tin; this is attributed to the unsettlement caused in the United Kingdom by the present labour situation in the transport industries and by an increase in the amount of nearby copper in the European market with a consequent lessening of the premium being paid.

#### COPPER MARKS TIME

The copper market itself has been featureless, with reports continuing to come from America of decreasing requirements at almost every level of the non-ferrous industry, but in spite of this the customs smelter price has been maintained at 23½ c. per lb. and sufficient business appears to have been done to enable the normal intake of scrap to be absorbed. Comment has been widespread upon the administration's plan to subsidize prices, but so far very few voices have been raised in support, the majority appearing to agree with the opinion expressed in this column last week.

In the U.K. business has continued at a level which is only very little below that established last year, and with the report that licences will be granted for an additional tonnage of wire to be exported to China during the second half of this year, prospects are still considered reasonable. Stocks in official warehouses showed a decline for the second week running and the total now stands at 18,207 tons.

On the Continent the peak of the

shortage of wirebars appears to be past, premiums are beginning to fall, and it is believed that the position will be back to normal by early June, provided that the strike in Chile is settled in the near future. If, however, this is prolonged then it is to be expected that another period of relatively high premiums for wirebars will occur in the third quarter.

#### TIN'S STRONGER UNDERTONE

As hoped for, the International Tin Council announced that there would be no alteration in the overall export quota for producing countries during the third quarter of this year. It was also announced that the tonnage held by the buffer stock at the end of 1957 was 15,300 tons, which conformed closely to expert guesses at the time. The next meeting is to be on June 17, but there is no reason to believe that this will be anything but routine.

A measure of the impact that the present quota is having upon producing countries can be gauged from the fact that in Malaya 144 mines have closed with 4,635 workers becoming unemployed. Shipments from Malaya during April totalled 3,875 tons against 3,333 tons in March, and of this tonnage only a little over 450 tons were shipped to the U.K., the U.S. taking just over 1,000 tons, Europe and Japan between 500-600 each, and India about 450 tons, the balance going to the usual destination.

In the U.K. stocks in official warehouses rose by 934 tons, but it is believed that the buffer stock manager had

to absorb only a small portion. The general undertone, however, has strengthened considerably and the long expected rise of price is now considered by a number of authorities to be imminent, but the market has been disappointed so often before that something more than sentiment will be necessary before the price level moves up on any firm basis. On Thursday morning, the Eastern price was equivalent to £748½ per ton c.i.f. Europe.

#### EFFECTS OF LEAD/ZINC CUTS

The lead and zinc markets remain featureless, but it would appear that the cuts in production are gradually being reflected in output figures, and it can therefore only be a matter of time before refinery outputs also commence to fall, although, after the experience gained from the tin market, how long this process will take is impossible to foretell.

In Australia, the Zinc Corporation's lead output is now 28 per cent below the average for the second half of 1957, and the zinc concentrate production is down by 30 per cent as compared with the same period. New Broken Hill's output of lead concentrates is 25 per cent below the average for the second half of 1957, and their zinc concentrate output is 32 per cent down. In Europe, the refinery productions remain practically constant, the lead production in O.E.E.C. countries being 51,400 tonnes in March against 48,447 in February, the corresponding figures for zinc being 71,979 tonnes against 65,263 tonnes.

In the U.S. demand fluctuates considerably, as there have been days in recent weeks when the off-take has reached almost normal proportions due to the placing of orders by individual consumers. This seems to indicate that at long last stocks in consumers' hands are reaching a dangerously low point and that metal has to be bought to fulfil any sizeable orders placed. It is hoped that the expected slight upturn in steel production will help the zinc trade. Unfortunately, it appears that there will be very little upturn in the automobile industry, more especially as it is now understood that the 1958 models are likely to be even bigger in all respects than those produced in 1957 and which proved so difficult to sell. It will apparently be two years before the three main motor corporations are able to complete retooling to produce models which have a more popular appeal.

Closing prices are as follows:

	May 1		May 8	
	Buyers	Sellers	Buyers	Sellers
<b>COPPER</b>				
Cash ..	£177½	£178	£177	£177½
Three months ..	£179½	£179½	£178½	£179
Settlement ..		£178		£177½
Week's turnover	7,475 tons		7,125 tons	
<b>LEAD</b>				
Current ½ month	£72½	£73½	£72½	£72½
Three months ..	£73½	£73½	£72½	£72½
Week's turnover	4,125 tons		3,000 tons	
<b>TIN</b>				
Cash ..	£730	£730½	£731	£731½
Three months ..	£733	£734	£735½	£736
Settlement ..		£730½		£731½
Week's turnover	1,015 tons		795 tons	
<b>ZINC</b>				
Current ½ month	£62½	£63	£62½	£62½
Three months ..	£63	£63½	£62½	£62½
Week's turnover	4,575 tons		3,450 tons	

London Metal and Ore Prices appear on page 551.



**Mining Finance****Do You Believe In Uranium?**

Every year Peter Pan asks do you believe in fairies? Stockholders in Rio Tinto must ask themselves, do they believe in uranium? When they have read the address by the Hon. Robert H. Winters, president of the Rio Tinto Mining Company of Canada, and have digested the statement (see page 547) by Mr. Gerald Coke, chairman of the Rio Tinto Company itself, issued this year with the annual report, stockholders will no doubt repeat the classic answer "Yes".

This answer will have to be given in the teeth of pending news about the uranium contracts between the U.S. and U.K. governments and the South African producers that is generally expected to contain some unfavourable revision so far as the mines in the Transvaal and Orange Free State goldfields are concerned.

Rio Tinto stockholders should take heart about their 30 per cent stake in uranium, mostly Canadian, for two principal reasons. (The 30 per cent arises from the belief that Tinto's current investments are divided approximately as to 40 per cent in Rhodesian copper, 30 per cent in uranium, 20 per cent in oil and 10 per cent in etceteras.) Firstly, the huge contracts with the Canadian Government buyer brook no revision on a poundage basis. Secondly, the Rio Tinto group will within the next few months already have sufficient plant capacity to supply additional consumers in those countries with which Canada has, or will have, established bilateral arrangements. This state of affairs means that an organization even at this stage is being developed for new methods of processing uranium oxide and selling it on a world-wide basis. Tinto is thus confident that when the sixties bring the expected fierce free-market competition in uranium sales, it will already have acquired considerable marketing experience.

Meanwhile, Tinto is subject in the short term to the economic fluctuations in copper prosperity that contrast sharply with the guaranteed market for uranium that will obtain for the next few years. The stake in Rhodesian copper already produced less revenue in 1957, but this was largely made good by the income from the newly acquired Kern Oil Company. In the current year it is a fair estimate that Rhodesian copper dividends will be at least halved. At the same time Mr. Coke gives a warning implying that in the present state of the oil market Kern is unlikely to pay more this year. Canadian uranium, despite the fact that full production will be reached this summer, cannot yet come into the picture as an income booster because heavy prior charges have to be amortized. Consequently, it may be around 1961 before the first fruits of this investment starts to accrue to the U.K. parent company.

All this enables a fairly clear view to be taken of the prospects for Rio Tinto 10s. stock units at their current price of 60s. cum the 1957 dividend of 26 per cent less tax, which was approximately equivalent to the tax free 15 per cent paid for 1956. The first thing to be taken into account is the modest yield of 4.4 per cent offered by last year's payment.

This implies a market price that is already discounting some of the long-term uranium revenue to come. How long-term this will be has already been indicated.

This brings out the second point, namely: that for 1958 the very most that can be expected is maintenance of last year's distribution. The holder of Tinto may well be content with this prospect. The prospective buyer, on the other hand, may be excused if he holds off until he can see a more joyful outlook for copper and oil. But in his timing he will have to bear one thing clearly in mind. Tinto already yield as much, if not more, than some Rhodesian copper shares on the basis of the latter's potential 1957-58 payments. With the exciting prospects from uranium yet to come, Tinto units could thus be particularly responsive to any real turn for the better in the copper outlook.

**NO ROAN INTERIM?**

Since Rhokana halved its interim last March for the year to June next, there has been a tendency to regard the 1957-58 dividend reductions for the Rhodesian copper producers as likely to be generally of this calibre. Rhokana does not publish quarterly reports. Roan Antelope and Mufulira in the Rhodesian Selection Trust group do. The latest ones for the March quarter indicate that the dividend cuts may well be more severe than this. Roan, Mufulira and R.S.T. are due to announce their interims at the end of next week.

For the first nine months of the current financial year Roan's profit before tax has dropped from £5,512,000 to £1,443,000. Mufulira's from £7,828,000 to £2,782,000 and Rhodesian Selection's proportion of profits represented by its 64 per cent interest in Mufulira and the new producer Chibuluma from £5,834,000 to £2,156,000. Here are hefty reductions indeed. True, there may be some recovery in the final quarter when special efforts are generally made to catch up with sales while there has also been a modest improvement in the metal price.

Even so, the market has now revised its dividend thinking along the lines of possibly as little as 4d. gross for Roan equal to 2½d. after Rhodesian tax against 11½d. for 1956-57. Whether or not this is too pessimistic will probably depend on the course of the metal market between now and next October when the final dividends are generally declared. Any marked improvement in the copper price would justify the Board in being more generous in their distribution of 1957-58 profits than they would be if the metal is then still depressed.

As regards next week's interim the market will not now be unduly shocked if Roan pays nothing at this particular juncture. Mufulira and Rhodesian Selection, however, should be able to make some distribution, lower though these must be. Last year the R.S.T. interim was 8d. gross followed by a final of 1s. 4d. equal to a total of 1s. 3d. after

Rhodesian tax. A total of around 6d. after this tax is the current market estimate for 1957-58.

An interesting point about the Chibuluma quarterly is that cobalt sales have started. The March quarter sales were 260 tons and they resulted in a loss of £165,000. This deficit is due to plant teething troubles and the fact that operations during the period were on a relatively small scale. All the cobalt is being sold to the United States Government under the agreement whereby that country participated in Chibuluma's initial financing. Most of the company's copper goes to the same quarter. It is worth bearing in mind that until the U.S. loan of £5,000,000 is repaid in this manner R.S.T. will not begin to get any income from its important stake in this mine which has made a profit before tax in the first nine months of its current financial year of £711,000 against £1,401,000 in the same period of last year.

**RAND AND O.F.S. RETURNS FOR APRIL**

Production and profit returns from the South African gold producers for the month of April were good. In general terms more ore was put through the mills, working costs were lower, and these factors combined to more than offset the fact that the gold price at 248s. 8d. was a 1d. per oz. less than in the previous month.

West Driefontein easily held its place as the leading profit maker, followed by Hartbeestfontein, Blyvoors and President Brand. Several other young mines did well, including Western Holdings, Free State Geduld and Welkom and Virginia.

Unfortunately, Freddie Consolidated returned a loss of £9,644 against a profit of £3,485 in March, the first working loss incurred since last October.

At Harmony, both the tonnage and the working costs were affected adversely by the necessity to undertake non-productive work preparatory to an expansion in operations. Profits dropped £30,000 to £227,000.

Of the older mines, the return from Daggafontein was very good with profits up £21,000 to £397,000. Brakpan showed an improvement, but E.R.P.M. returned lower working profits while New Kleinfontein reported a loss of £12,815 against a profit in March totalling £506.

**NEW COAL SHARE**

Recent activity in the 4s. stock units of Henderson's Transvaal Estates may be explained by the intention to make a London market in the £1 Ordinary shares of Tweefontein United Collieries, the company's principal South African coal interest. An information statement regarding this concern is expected to be published next week and application is to be made to the Council of the London Stock Exchange for permission to deal in



the whole of the issued Ordinary capital of £433,750 which has hitherto only been quoted in Johannesburg.

It is intended to repay the Preference capital of £150,000 in the not far distant future. Steady dividends have been paid on the Ordinary. Last year's distribution was 3s. 4d. per share and this is expected to be maintained in 1958. In 1957 Tweefontein United Ordinary fluctuated in Johannesburg between 41s. and 32s. 3d. Henderson's are currently quoted in London at 8s. 6d.

#### AMAL BANKET DOING BETTER

Although profits suffered a setback in March when the working surplus of £39,671 compared with £50,574 in February, things have been going better with Amalgamated Banket Areas, the Ghana gold producer, since the middle of 1957. The March quarter working profit of £140,937 contrasts with as little as £52,253 in the June quarter of last year. It brings the surplus for the first half of the current financial year to September 30 next up to £248,977 against only £158,531 in the same period of 1956-57. The 1957-58 figure includes £24,536 under the grant awarded to low-grade concerns by the Ghana Government following the African wage increases in 1956.

In the light of these better results the chairman, Major General W. W. Richards, has been able to state in his review accompanying the recently published annual report that the company's finances have improved "very considerably" and he hopes that a strong liquid position will have been re-established by the end of this year. At September 30 last the balance sheet shows that if the large item of £477,409 for stores is left out of account, current liabilities exceeded current assets by £146,092.

A profit of £35,730 was made in 1956-57 against a loss of £205,884 in the preceding year when operations were seriously disrupted by the prolonged African labour strike. There is, of course, again no dividend. The last payment was 10 per cent on account of 1954-55. During the past year all Amalgamated Banket's ore has been coming from underground, opencast mining at Pepe having been discontinued in 1956. There has been a consequent improvement in the grade of ore milled which yielded 4.89 dwt. per ton in the March quarter compared with under 4 dwt. a year ago. The mine's ore reserves at September 30 last stood at 1,281,107 tons with an average gold content of 5.487 dwt., a decrease of 53,741 tons over the twelve months and of 0.121 dwt. in grade. These reserves are equivalent to around 1½ years' mill supply at the monthly target rate of 65,000 tons.

Amalgamated Banket 3s. stock units are quoted at 1s. 3d. Any real improvement in this price depends on a resumption of dividends or anticipation thereof. The financial year 1958-59 looks to be the earliest period for which such a revivifying influence could take place. But any increase in the gold price could totally transform the situation for a mine such as this.

#### SURPRISE FROM BRITISH TIN

Shareholders in British Tin Investment, disappointed with the, if anything, adverse effect that the Overseas Trade Corporation tax concessions have had on their company, will gain some solace from this week's announcement that the

flat rate of profits tax introduced in the 1958 Budget will have a favourable influence on the tax position as from April 1 last. Under the two-tier profits tax British Tin has already paid distributed profits tax on income which has been carried forward. In order to pass on the benefit that will now accrue an extra 10 per cent dividend is to be paid on the 10s. shares for 1957. This distribution will be mainly provided out of earnings from previous years. It will bring the 1957 total payment up to 35 per cent against 28 per cent for 1956.

There is, however, an important qualification in the company's statement. This extra distribution will substantially reduce the figure of net revenue carried forward at the end of 1957 and the board consider it essential to restore the position in this respect out of the net revenue for the current year. This policy, it is pointed out, will involve a corresponding reduction in the net earnings available for the payment of dividends for 1958. The interim for that year (6½ per cent last year) is thus to be passed. In effect, instead of this interim, shareholders will be receiving in August the additional payment now declared for 1957.

The net revenue for 1957 of British Tin and its subsidiaries amounts to £337,669 against £352,384 in 1956 after tax of £308,334 compared with £275,510. The

1957 dividends require £423,648 net against £338,919 in 1956. The question now to be resolved is on what basis B.T.I. shares should be regarded from a yield viewpoint. They stand at 15s. 3d. A cautious assessment would be to look upon the latest 10 per cent as something of a special distribution and to take 25 per cent as being the true dividend for yield purposes. After allowing for the payment still included in the price the return would even then be around 17 per cent. The reason for this generous yield is that the share price is already discounting to some extent the prospect of lower revenue in 1958 from the company's extensive tin portfolio owing to the impact of output restrictions on producers' earnings. Tin still looms large in British Tin's affairs despite the policy of investment diversification that has been pursued in recent years.

#### BRITISH ALUMINIUM CO.

Total consolidated profits of the British Aluminium Co. in 1957 were £1,247,389 against £1,330,989 in 1956. Net income attributable to the parent company was £1,562,270, from which dividends totalling 12 per cent on the increased ordinary stock were paid, absorbing £575,000 against £483,000 last year. (Chairman's statement is on page 549.)

### LONDON MARKET HIGHLIGHTS

The appearance of two dark clouds on the horizon effectively blotted out the recent glimmerings of hope in the South African gold share market last week. Firstly, it was understood that the current level of South African uranium production was among topics discussed in the inter-Governmental talks begun in Pretoria on Monday. No official announcement was issued from these talks—although one is expected shortly—but the general market inference was that proposals for some form of curtailment in South African uranium output might emerge. It was argued that such a move would be quite feasible in view of the rapid build-up in uranium production during the past few years.

The second unsettling influence was some apprehension about the continuing drain on South Africa's gold and dollar reserves. It was thought likely that some credit restriction measures would be proposed shortly to deal with the problem. Such measures could very well subdue dealings in gold shares at Johannesburg.

In the circumstances, gold share prices lost ground throughout the list. Gold-uraniums were the worst hit; among them Randfontein fell to 23s. 9d., Luipaards to 10s. 3d., Buffels to 36s. 6d. and Hartbeest to 57s. Harmony (32s. 7½d.) were additionally upset by the labour dispute while it lasted. Another weak feature was in St. Helena, which tumbled to 38s. 6d. Older dividend payers such as City Deep and Crowns kept up well on a quiet but steady Cape demand for a while, but later succumbed to the general trend.

Dealings began in the Free State Saaiplaas new combined units of one 10s. convertible note and three ordinary (10s.) shares; the market initially welcomed the issue by setting a premium of 1s. 9d., but this quickly wilted to 1s. on Cape selling.

After their still unexplained revival in the previous week, platinum shares gently

faded out of the picture, but later showed signs of coming back. Also quieter were Henderson's as "take-over" talk became less insistent. Even so, the coming marketing in London of the company's Tweefontein Colliery was still confidently forecast and Henderson's shares were reluctant to ease below 8s. 6d.

The big event of the week in copper shares was the advent of the R.S.T. group March quarterly results. Profits showed a sharp decline—greater possibly than had been expected—but after easing a few pence to start with, both Roan and R.S.T. quickly rallied. The rest of the market kept fairly steady, too, but the London bus strike, with its implications of further labour unrest and the consequent effects of this on metal demand, was a subduing influence.

Tins also lost little ground, although the earnings picture can have hardly been helped by the decision of the Tin Council to prolong the severe export quota restrictions for a further three months.

Lead-zincs, however, were definitely unhappy: particularly in view of the apprehension surrounding the coming final dividends and preliminary profits from New Broken Hill and Consolidated Zinc. In the event, these gloomy forebodings proved unjustified. Helped by higher production last year and O.T.C. concessions, N.B.H. surprised everyone by announcing an increase in profits despite the fall in lead and zinc prices in 1957. As far as Consolidated was concerned, it was considered that the reduced dividend was not nearly so bad as some guesses had indicated. Both shares promptly rallied on the news, but dealers reported that buying response was poor.

Mount Isa, on the other hand, held steady in front of their interim dividend. This proved also to be reduced less than had seemed likely and the shares hardened to 21s.

## THE RIO TINTO COMPANY, LIMITED

### DEVELOPMENT OF GROUP'S INTERESTS

### MR. GERALD COKE ON LONG-TERM PROSPECTS FOR URANIUM

#### BENEFITS FROM ACQUISITION OF KERN OIL

The 85th annual general meeting of The Rio Tinto Company, Limited, will be held on June 5 at Barrington House, 59, Gresham Street, London, E.C.2.

The following is the statement by the chairman, **Mr. Gerald Coke**, which has been circulated with the report and accounts.

This year the Chairman's Statement is being circulated with the Accounts instead of being delivered as a speech at the Annual General Meeting. It is intended to follow this procedure in future and so give shareholders a more comprehensive picture of the Company's activities. The remarks made in this Statement should be read in conjunction with the Report of the Directors and the Review of Operations which accompany the Accounts.

#### Accounts

It is hoped that the further changes in the presentation of the Accounts will make them more easily understood and more informative. There are one or two points to which attention should be directed. The increase from £3,270,000 to £15,393,000 in the figure for capital reserves in the balance sheet of the parent Company is due to the premiums arising from the issue of 2,311,200 ordinary shares in exchange for shares of the Kern Oil Company Limited and of the further issue in October 1957 of 2,085,200 ordinary shares at 50s. The increase in the amount on deposit and in Treasury Bills from £1,400,000 to £5,633,000 represents the short-term investment of the proceeds of the rights issue. Since the end of the year the greater part of this sum has been remitted to Canada to enable Tinto Holdings to take up the rights accruing to your Company from the fresh issue of capital made by The Rio Tinto Mining Company of Canada and to subscribe for debentures in Northspan Uranium Mines Limited. The reduction in investments from £4,364,000 to £3,020,000 is due to the sale of a security held temporarily for income purposes and does not imply any reduction in the Company's holdings in the Rhodesian copper producing companies.

A large part of your Company's income is derived from its Rhodesian investments. The dividend received from subsidiary companies, which, of course, is principally derived from the Kern Oil Company, has gone some way to making good the fall in income from the copper producing companies in the year to December 31 last. The Kern Oil Company must, however, retain sufficient resources for development purposes and its profits must depend on the future trend of oil prices. On the other hand, the income derived from the Rhodesian investments is bound to be smaller during the present year due to the fall in the price of copper, which was not fully reflected in the dividends received during the year under review and the total income available to the parent Company will be correspondingly reduced. In due course substantial income will, it is hoped, arise from your Company's uranium investments, but it must be appreciated that both the producing companies themselves and The

Rio Tinto Mining Company of Canada, which is the holding company, have heavy prior charges to amortize before the equity can expect any return.

#### Spain

During the year we received a first dividend of 6 per cent. on our investment in the Spanish mine. The declaration of this dividend represents the culmination of much hard work on the part of those responsible for the management of *Compañía Española de Minas de Río Tinto*, and the Board would like to offer them congratulations on the success of their efforts. This successful example of co-operation presented by this association between a British Company and a leading group of Spanish bankers and industrialists should be widely recognized as an example at the business level of what may be achieved in the higher realms of international affairs. We would wish to record our confidence that this happy relationship will continue to our mutual benefit and to express our best wishes to all our Spanish colleagues—and in particular to the Conde de Benjumea, the President, and to Señor Torres, the Managing Director of *Compañía Española de Minas de Río Tinto*—for the further success of their affairs.

Mr. P. H. Truscott, formerly Administrative Deputy Manager at the Rio Tinto mines and now Secretary of The Rio Tinto Company, Limited, has joined the Board of *Compañía Española de Minas de Río Tinto* as one of the British Directors in place of Mr. H. A. Mellor, who has retired.

#### Canada

We have been fortunate in securing as the President of The Rio Tinto Mining Company of Canada the Hon. Robert Winters, formerly a Cabinet Minister in the Federal Government. Mr. Winters took over this appointment at the beginning of September 1957 and his knowledge and personality have permeated all the activities of our Canadian associate. We are confident that under his direction the Company will prosper and we are happy to know that its affairs are now in the hands of such an eminent Canadian.

The appointment of Mr. Winters has relieved Mr. Duncan of the necessity to occupy the post of President of the Canadian Company as well as of Managing Director of The Rio Tinto Company, Limited. The Board of your Company would wish to express their gratitude to Mr. Duncan for the zeal and energy which he brought to this dual task, involving, as it did, frequent journeys between this country and the American Continent and the overcoming of all the problems inherent in having executive responsibility in two companies separated by 3,000 miles. Mr. Duncan remains a Director of The Rio Tinto Mining Company of Canada and in this capacity is able to maintain the fullest liaison between the two companies.

The appointment of a Canadian President has also enabled Mr. R. W. Wright, who was loaned from the parent Company to act as Managing Director for the

Canadian Company, to return to this country, where he has joined the team of full-time Directors. The Canadian Company had to be built up almost overnight from the nucleus of an exploration organization into a self-contained mining company, constructing at an unprecedented rate eight mines and seven mills in the Blind River area alone. In addition to this task, as a result of the merger of the Group's Canadian interests with the mining interests of Mr. J. H. Hirshhorn, it was necessary to carry out simultaneously a major reorganization of the holdings acquired by The Rio Tinto Mining Company of Canada in over forty different companies. During all this period Mr. Wright was executive Managing Director of the Canadian Company and your Board would like to acknowledge the fine job performed by him and his colleagues.

#### Capital Expenditure

The principal problem which the Canadian Company has had to face during the year has been the over-run in the capital expenditure on the uranium mines of the Northspan Company. Information about this over-run was given to shareholders only a few months ago at the time of the recent issue of capital. Such over-runs are common to nearly all mining enterprises, especially in a time of rising prices, but there is no doubt that in this particular case the speed with which the whole operation had to be carried out inevitably led to under-estimation and some excess of expenditure. It need hardly be emphasized that, because the contracts for the sale of the oxide were limited in time and the product was urgently required, this speed was essential. As will be noted from the Review of Operations, the capital cost of the Milliken Lake mine, which is the last of the Rio Tinto Group's mines in the Blind River area to be brought into operation, is unlikely to exceed the moneys raised for the purpose, including bank facilities arranged to provide working capital.

In the Chairman's speech last year some reference was made to the size of the Company's enterprise in the Blind River area and, if this factor, together with the rapidity with which the mines have been brought into operation is taken into account, the excess expenditure is not proportionately high, though, when such large sums are involved, it naturally follows that the additional amounts required are large expressed in terms of money. The raising of these large sums presents a further example of satisfactory international co-operation. The parent Company felt that it must ensure the completion to the point of active production of the uranium mines under the management and control of The Rio Tinto Mining Company of Canada, and so has made arrangements to ensure that the necessary finance is available. This additional finance has been found by way of bonded indebtedness and the amounts advanced, which we expect to be repaid during the currency of the present contracts, will in due course become available for re-investment in other enterprises. The overall financial picture of these uranium mines to the end of the present contracts can, therefore, be viewed as not unsatisfactory, and the outside shareholders in the various enterprises have benefited from the support which association with a world-wide group of companies confers. Your Board would like to pay tribute to the co-operation which they have received from the banking community on both sides of the



Atlantic in ensuring the financing of these mines to completion.

#### Uranium

In the Chairman's Speech for 1956 reference was made to the long-term prospects for uranium. Since then more is known of the long-range possibilities of the fusion process as a means of producing power for civil purposes. This factor was, however, taken into account in the estimates tentatively given and it does not appear that there are any new factors which would suggest any major revision of those estimates. The expanding requirement for power is the principal factor on which the demand for uranium will be based. Some estimate of the size of this demand was made by Sir Edwin Plowden in an article published in December 1957, and it would be difficult to find a better authority to quote. His article, which was published in *Optima*, the journal of the Anglo-American Corporation, for December 1957, may be recommended to all who are interested in the probable future demand for uranium. It would overburden this statement to quote the article in extenso but Sir Edwin's conclusions are a succinct summary of the position:

This (the British) expanding programme will require an increasing annual tonnage of uranium. Between 1,000 and 2,000 tons a year of uranium oxide will be required from the time the first stations have to fuelled, that is to say, from 1961 onwards. The demand will increase steadily until well into the 1970's, when it will probably lie between 5,000 and 10,000 tons a year . . .

Dr. Libby, a member of the United States Atomic Energy Commission, estimated American civil uranium requirements at 20,000-30,000 tons of uranium oxide by 1975. It is possible, therefore, that the total amount of uranium needed by the free world for civil purposes in the 1970's could well be in the region of 50,000 tons a year and still rising.

He goes on to point out that production is also rising and prices should in due course become competitive, and he concludes:

One of the conditions for a continuing high demand is that it (uranium oxide) should be produced cheaply and for those established mines which can do this, and for those who can find economical new sources of supply, there should be an ever-growing market.

After the termination of the present Government contracts and with the background of the experience gained as the world's largest uranium producer, the Group should be capable of fulfilling these conditions and maintaining its competitive position.

In addition to meeting the deliveries of uranium oxide required under existing Government contracts, the Group will, within the next few months, have sufficient plant capacity to supply additional consumers where governmental bilateral arrangements permit. The Group is also developing an organization for research into new methods of processing the oxide and for selling it on a world-wide basis. We believe that the products we have to offer will be found to be competitive and, with the substantial sources of supply which the Group can command, the intending purchaser should have a guarantee of delivery in the quantities and qualities he is likely to require.

#### Australia

As will be seen from the Review of Operations, the Mary Kathleen mine is

expected to begin production earlier than the date originally forecast. It is greatly to the credit of all those concerned with the construction of this mine that this has been made possible and the achievement, which includes the construction of a complete township housing over a thousand people, together with all the amenities necessary in a place 500 miles from the coast, is one which has captured the imagination of the Australian people. We congratulate our Australian associates on this achievement, which augurs well for the future of our Australian organization.

#### Africa

During the course of the year Mr. R. H. W. Bruce retired from the chairmanship of our African Companies and as our representative on the Boards of the Rhodesian copper producers to devote more time to his interests in Scotland, where we wish him every success. His place has been taken by Brigadier M. A. W. Rowlandson. Since the end of the year Mr. Oscar Weiss, who for the last five years had been in charge of our exploration work in Africa, has left the organization.

During a time of falling metal prices a mining group such as the Rio Tinto Group must have special regard to the possible returns from any development or exploration work which they undertake. It is a well-known fact that base metal prices fluctuate widely due to causes entirely outside the producers' control. Ideally it would be desirable to arrange an exploration programme so that a new mine could be developed towards the end of a period of recession and start its operating life on a rising market for the particular mineral concerned. In practice, of course, it is not possible to ensure that discoveries are made at the right moment in time. Moreover, it is normally only in a time of rising prices that the large financing necessary to bring a modern mine into production can be carried through. The policy of the Group at this time, therefore, when falling income from investments would also suggest reductions, is to slow down expenditure on exploration. Your Board feel, however, that it is essential to maintain an active exploration organization in any area where there are reasonable prospects of such activities bearing fruit, and in particular to ensure that their organizations in the Federation and the Union, as well as in Canada and Australia, are fully prepared to take advantage of any improvement in base metal prices.

#### Oil

The Kern Oil Company has been a member of the Rio Tinto Group for nearly a year and its organization is now working as an integrated part of the whole. Mr. G. W. Ivey, the Chairman of the Company, and his staff have given added strength to our team and we have been happy to welcome them.

The merger of the Kern Oil Company brought with it a considerable number of new shareholders, as is illustrated by the fact that the number of members on our Register has increased from 2,680 to 11,310. This too we welcome.

For the benefit of those shareholders who are not familiar with the extent and scope of its operations, a description of the Kern Oil Company's activities is included in the material published with the Report and Accounts. This acquisition does not merely mean an increase in our revenue and an extension of the number of investors having a stake in the Rio Tinto Group; it is a most important and

valuable diversification of our interests. The Kern Oil Company has well-established oil production in Trinidad and California, together with reasonably good prospects of being able to extend reserves; and, what is equally important, they have an experienced team of management. Your Company thus has a good basis for further development in this new field.

#### The Board

We mourn the death during the year of Monsieur Emile Laffon, who had been a Director since January, 1954. Monsieur Laffon was well known and widely respected for his distinguished services to France during and after the War. His colleagues on the Board of the Rio Tinto Company had come to have respect for his views and affection for his personality.

We have been fortunate in securing Monsieur René Mayer as Director in the place of Monsieur Laffon. Monsieur Mayer's public service is too well known to need recapitulation here and we are convinced that his many qualities and his world-wide knowledge of affairs will be invaluable in our deliberations.

Mr. A. T. Gough retired from the Board on March 31, 1958. Mr. Gough, who, before joining the Board, had been the General Manager of the Company's properties in Spain from 1941 to 1950, has served for forty-six years with The Rio Tinto Company. We pay tribute to this lifetime of service, we acknowledge the assistance which his advice has given to the Board during the last seven years, and we wish him health and happiness in his retirement.

During the year Sir Archibald Nye has joined the Board. Besides his service to the country during the War, which is now a matter of history, he has enhanced the public's debt to him by undertaking a number of posts in civilian life, culminating in his becoming British High Commissioner in Canada. His wisdom on all matters and in particular his knowledge of Canada are a source of great strength to the Board, and we consider ourselves fortunate to be able to count him among our colleagues.

On his return to England, Mr. R. W. Wright joined the Board as a full-time executive Director. His knowledge of all our overseas activities gives strength to the management of the Group in London.

#### Auditors

Since the Company was incorporated in 1873, Messrs. Turquand, Youngs & Co. have been its auditors. During a period when the sole active interest of the Group was its Spanish mines Messrs. Turquand, Youngs & Co. have ably fulfilled their task. Now that the Group is spread over four continents and over multifarious activities your Board have considered it wise to appoint joint auditors and, in full agreement with Messrs. Turquand, Youngs & Co., Messrs. Cooper Brothers & Co., who act for a number of our overseas Companies, will be proposed to the General Meeting for appointment as joint auditors. We are indeed fortunate to have the services of two such eminent firms of world-wide reputation.

#### The Staff

Tribute has been paid by the Boards of our overseas Companies to the magnificent work performed by the staffs of those Companies. There is little to be added to these tributes, except to express our admiration at the prodigies of construction and development which have been achieved. The Board of the parent



Company would, however, like to record its gratitude and its appreciation to the senior members of the management of the principal overseas Companies in the Group. We fully realize that, without their inspiration and leadership, the results which have been achieved would not have been possible.

The Board of The Rio Tinto Company Limited would also wish to take this opportunity of thanking all members of the staff of the Head Office, who have contributed materially to the cohesion and success of our efforts throughout the world.

## MERRIESPRUIT (O.F.S.) GOLD MINING COMPANY

(Incorporated in  
the Union of South Africa)

### MR S. G. MENELL'S REVIEW

The 9th annual general meeting of Merriespruit (Orange Free State) Gold Mining Company Limited will be held on June 9 in Anglovaal House, 56 Main Street, Johannesburg.

The following is the Review by the Chairman, **Mr. S. G. Menell**, which has been circulated with the report and accounts:

Initial progress on the first stage of the scheme for dewatering your Company's mine through the pumping system of the Virginia mine via the extension of its 28th level haulage towards your Company's No. 1 Shaft was retarded by the intersection of water-bearing fissures which required cementation before the continuance of any further development. The advance during the year of this twin haulage towards the common boundary of the two mines was, therefore, restricted to 583 feet. Since the end of November progress has improved and, during the first quarter of the current year, the advance was 1,385 feet. The furthest point reached by the twin haulage at the end of March was 605 feet from the common boundary.

It was found that the water level in both shafts was virtually the same, but for technical reasons it is measured in No. 2 Shaft instead of in No. 1 Shaft.

During the year, the water level dropped by 214 feet from 645 to 859 feet below No. 2 Shaft collar.

In terms of the contract entered into with Virginia Land and Estate Company Limited for the sale of mine housing by your Company, an amount of £700,000 was received during the year. The purchase price is £1,700,000 of which £1,200,000 is payable at the rate of £100,000 per month and the balance of £500,000 when your mine resumes normal production.

Expenditure during the year amounted to £283,494. Of this amount £14,400 was spent on the completion of the gold plant and £29,795 on completion of the uranium plant, to which expenditure your Company was committed prior to the flooding of the mine.

In order to reduce overhead expenses to a minimum, the mine has, since April, 1957, been placed on a care and maintenance basis under the control of the Manager of the Virginia mine. No employees are at present on the books of your Company.

## BRITISH ALUMINIUM

### HEALTHY RECOVERY IN HOME DEMAND

The Annual General Meeting of The British Aluminium Co. Ltd. was held on May 6 in London.

**Marshal of the Royal Air Force, The Rt. Hon. Viscount Portal of Hungerford, K.G., G.C.B., O.M., D.S.O., M.C.**, the chairman, in the course of his speech said:

The consolidated profit for the year after tax amounted to £1,247,389, which compares with £1,330,989 for the previous year.

The lack of rainfall in Scotland, to which I referred last year, again to some extent influenced our primary operations. Although Kinlochleven produced a record output, Lochaber was only able, on account of temporary water shortages, to produce about the same tonnage as in the previous year.

Our alumina works operated satisfactorily and had a steady load. I will refer later to our primary operations overseas.

At our rolling mills and extrusion works, however, operations again had to be curtailed slightly, due in some degree to a falling off in home demand, but more particularly to difficult conditions in export markets.

The price of aluminium ingot remained stable at £197 per ton throughout 1957; but it was necessary to increase the selling prices of our fabricated products to a small extent in the middle of the year on account of a wage increase of approximately 5½ per cent. On the other hand, prices of competing non-ferrous metals continued to fall throughout the year, notably the price of copper, which fell by 33 per cent and has since fallen still further. Lead and zinc prices fell by 40 per cent. Nevertheless, in spite of these price reductions, aluminium still enjoys a substantial price advantage on a volume basis.

### Credit and Other Restrictions

During the last decade the growth of the United Kingdom aluminium industry has been quite spectacular and in line with that of the world aluminium industry; but in the latter part of 1956 and throughout 1957 there has been some recession in demand for aluminium products from the high level reached in 1955 and 1956. Most of the factors contributing to the recession in demand in the United Kingdom have operated to varying degrees in most Western countries, including the United States and Canada, and are quite well known. They have arisen from attempts by Governments to control inflationary tendencies by restricting credit and because of the increase in supplies of virgin aluminium, which has for the time being overtaken demand.

Home demand for aluminium products made a healthy recovery in the latter part of 1957, indicating that manufacturers had absorbed stocks and were purchasing at a rate comparable with the level of production of the country.

During this period your Company fully maintained its position as a leading supplier and a most encouraging feature of 1957 was the stability of the overall demand from the principal industries using aluminium.

### Overseas Market Trends

The trend in overseas markets, however, deteriorated considerably during the year. Competition from several sources in many overseas markets during the last

year or two has reduced prices to levels which are now quite uneconomic for any exporter. This has been the principal cause of reduction in output of fabricated products in the United Kingdom and is likely to continue to be a dominating factor until world demand begins to catch up with metal supplies.

The advent of the European Common Market and the possibility of a wider European Free Trade Area being established are being studied very closely, and we are confident that under fair trading conditions we can compete favourably in European markets.

With the prospect of further substantial expansion of production of virgin aluminium in the Western world during the next five to ten years, expansion of demand to absorb the increase depends to a very large extent on the improvement of fabricating processes and the development of new bulk uses.

### World Supplies

For a long time we have been in a position where aluminium has been in short supply. This is unsatisfactory to everybody. The whole past history of the aluminium industry indicates concentration on development and expansion, and this must inevitably be hampered unless metal is in adequate supply. After an unsuccessful race to keep production in line with consumption, the time has come when productive capacity has suddenly exceeded demand.

How long this condition will last I would not wish to predict. It depends on so many different factors. Of two things, however, I am convinced. Firstly, we had to have an excess of supply before the next round of expansion could come. Continued shortage would have stultified development to an increasing degree. Secondly, the time will come when not only all the present facilities, but all the great schemes upon which active exploratory work is proceeding will be required. We have complete faith in the long-term expansion of our industry.

A few years ago some of us saw two possible factors which might hamper our industry in the long term by raising costs in relation to other materials. One was doubt about the availability of reasonably priced power. Apart, however, from great hydro-electric resources, some made more feasible by the prospect of improved forms of transmission, other forms of power seem almost certain to be available in the more distant future. The other problem was the failure of the major producing companies, probably due to the war, to make adequate major discoveries of bauxite reasonably located for local processing and shipping. This seemed to present a picture where either greatly increased transport costs might be involved, or ores might have to be used from which extraction of alumina was more expensive. However, by virtue of recent discoveries, this danger seems to have receded into the very distant future.

We recommend a Final Dividend of Eight per cent on the Ordinary Stock which, with the Four per cent already paid, makes Twelve per cent less Tax for the year.

The report was adopted and resolutions were passed converting the unissued Preference shares into Ordinary shares and approving the increase of the capital to £15,000,000 by the creation of a further 3,000,000 Ordinary shares of £1 each.

## RHODESIA-KATANGA COMPANY LIMITED

### MR. C. J. HOLLAND-MARTIN'S SPEECH

The Annual General Meeting of Rhodesia-Katanga Company Limited was held on May 7 at the Chartered Insurance Institute, E.C.2. Mr. C. J. Holland-Martin, M.P. (Chairman), presiding, drew attention to the following features:

#### Mineral Areas

It would now be necessary to await completion of the programme of more detailed prospecting in the north-west part of Area No. 2. It should, however, be stressed that in spite of indications of many minerals in the area, none has so far been shown to be economic.

#### Kansanshi Mine

The following further information has been received from the Kansanshi Copper Mining Company Limited with regard to the progress of research on the integrated ore treatment process:

"In June, 1956, the Board approved expenditure of £20,000 on research to be carried out by Battelle Memorial Institute on Kansanshi oxide ore. This programme was completed in December, 1957, when the Board approved, on the recommendation of the Consulting Engineers, a further programme of research to evaluate the technical and economic merits of a proposal for an integrated treatment process utilizing both sulphide and oxide ore reserves, the controlled roasting of sulphide concentrates providing the acid equivalent for leach-electrolytic winning of copper from both sources. At the same time, as it is possible that the sulphide reserves may be exhausted before the oxide reserves while using such a process, the economics of continuing production from oxide ore alone, using acid transported from the Copperbelt, were to be examined.

A comprehensive scale of testing has been made possible with arrival of all bulk samples of the various oxide ore types about mid-March.

Exploratory controlled roasting of Kansanshi sulphide concentrate confirmed that very high conversion of copper to acid soluble form, with low iron solubility, is feasible. The concept of including a proportion of the oxide ore in roaster feed to increase the utilization of sulphur for production of sulphuric acid equivalent has also yielded most encouraging results in preliminary tests. Optimum conditions have not yet been established, but are being determined in the pilot reactor with a weighted composite of the bulk oxide ore samples on charge. This operation is proceeding smoothly on a continuous basis.

The individual tonnage lots of oxide ore from bulk sampling have been crushed and assayed, followed by bench scale leach tests for comparison with the preliminary samples investigated earlier in the programme. Extraction efficiency for acid soluble copper has been confirmed, but a disturbing feature is the wide variation in characteristics of specific ore types examined by both Battelle and our Kitwe laboratories, with respect to acid consumption, impurity behaviour, sulphide copper content, etc., which are major factors influencing capital and operating costs of the proposed process. In general, the bulk samples composite, though conforming reasonably with re-

serve grade estimates for total copper, contains appreciable sulphide copper as compared with the earlier samples, and lower overall acid consumption is experienced. It is therefore uncertain whether provision must be made for the flowsheet complication of sulphide copper recovery, say by flotation of the leach residue at questionable efficiency, if experience at Nchanga is used as a criterion. Overall copper recovery for the process may be affected by this factor.

Conditions have been established in leaching the earlier oxide ore samples, for satisfactory purification of leach solutions, involving removal of iron and most of the alumina dissolved. Filtration of leach and purification of pulps was rather poor, indicating relatively large installations compared, say, with Nchanga practice for a given tonnage. These characteristics persisted, in handling pulps from leaching of the bulk ore composite, and investigations of methods for improvement of filtration are in progress. The dry grinding procedure for reduction of the oxide ore may be a factor.

Electrolysis of purified solution from leaching the bulk oxide ore composite is ready to commence, and will be followed in due course on solutions arising from combined leaching of oxide ore and roasted sulphide concentrate when correct conditions have been established.

Prospects for technical success of the process either integrated with sulphide roasting or on direct treatment of oxide ore alone appear quite favourable, though no comment on the economics is yet possible.

Costs of the investigation in March totalled £5,039, and cumulative cost to the end of March was £11,013."

Shareholders would be kept posted regarding further developments.

The report and accounts were adopted.

**GENERAL MANAGER** is required by the **NIGERIAN COAL CORPORATION** for three tours each of 18/24 months. Consolidated salary according to qualifications and experience in the range £3,000 to £3,500 a year. The officer will be required to join the Staff Provident Fund to which he will contribute 3 per cent of his salary and the Corporation 22 per cent. Outfit allowance £60. Furnished modern house available at £150 a year rent. Free passages for officer and wife. Assistance towards cost of children's passages and grant of up to £150 annually for maintenance in U.K. Liberal leave on full salary. The General Manager will be required to take control of the Corporation's activities and will be directly responsible to the Chairman. Candidates should be highly qualified Mining Engineers with considerable administrative experience. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M3B/44498/MF.

## FREDDIES CONSOLIDATED MINES, LIMITED

(Incorporated in the Union of S. Africa)

### SUPPLEMENTAL STATEMENT TO MEMBERS BY THE CHAIRMAN, MR. D. A. B. WATSON

(Delivered at the Fourth Annual General Meeting of Members held in the Board Room, Consolidated Building, corner of Fox and Harrison Streets, Johannesburg, on Friday, May 2, 1958, at 11 a.m.)

In the statement\* issued to Members on April 23, 1958, reference was made to the fact that operations during the first quarter of the year had been adversely affected by a seasonal shortage of labour. The labour position is to some extent improving and the rate of stoping increased during April, 51,000 tons being milled during that month as compared with an average of 46,000 for the first three months of the year. It is expected that production will again increase during May.

The sampled value of the ore stoped during the first four months of the year is in line with expectations but there was unfortunately a marked decline in the yield of gold per ton of ore milled during April as a result of which a working loss of £9,644 was incurred during that month.

The value of the development sampled in February and March of this year was lower than normal but in April there was an improvement in value. The average value of development sampled in each of the first four months of the year has been as under:

	Feet sampled	Inch-dwts.
1958		
Jan. ...	414	average value 336
Feb. ...	370	average value 228
March ...	450	average value 267
April ...	450	average value 342
	1,684	296

For the purposes of comparison it may be mentioned that the average value of the total footage sampled during the year 1957, namely 8,975 feet, was 328 inch-dwts.

While it is expected that the rate of production will increase during the next few months, the results of operations during that period will largely depend upon the grade of ore available for stoping. The future likelihood of maintaining stoping values at the required figure depends to a large extent upon the value of development sampled during the current year. While the results of sampling the limited footage achieved during the first four months of 1958 do not necessarily afford a measure of the probable value of the development which will be accomplished during the whole year, the results obtained to date must be regarded as relatively unsatisfactory, being below the average for the past two years. It is not possible at this stage to estimate whether there will or will not be an improvement in future months.

\* Published in "The Mining Journal", April 25, 1958.

Marking the 75th anniversary of the T.W.W. Group of Engineering and Industrial Undertakings, *Outline of Progress* reviews the field of activity in industry of each department and company of the group. The book is published by Thos. W. Ward Ltd.

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## Publications Received

A German publication, *Building Construction in Mining Districts*, by O. Luetkins, published by Springer-Verlag, Berlin, details construction measures designed to guard against damage from subsidence.

★

*The Enemies of Timber*, published by Cuprinol Ltd., is a handy reference book facilitating early and accurate recognition of dry rot and insect attacks in timber. The small book is priced at 2s. 6d.

## LONDON METAL AND ORE PRICES, MAY 8, 1958

### METAL PRICES

Aluminium, 99.5%, £180 per ton	Iridium, £22 oz. nom.
Antimony—	Lanthanum (98/99%) 15s. per gram.
English (99%) delivered, 10 cwt. and over £190 per ton	Manganese Metal (96% - 98%) £310
Crude (70%) £190 per ton	Magnesium, 2s. 5½d. lb.
Ore (60%) basis 19s. 6d./20s. 6d. nom. per unit, c.i.f.	Nickel, 99.5% (home trade) £600 per ton
Arsenic, £400 per ton	Osmium, £18/£20 oz.
Bismuth (min. 1 ton lots) 16s. lb. nom.	Osmiridium, nom.
Cadmium 10s. 0d. lb.	Palladium, £6 5s./£6 15s.
Cerium (99% net), £16 0s. lb. delivered U.K.	Platinum U.K. and Empire Refined £26 15s. oz.
Chromium, Cr. 99% 7s. 2d. lb.	Imported £22/£22 10s.
Cobalt, 16s. lb.	Quicksilver, £76 10s. ex-warehouse nom.
Germanium, 99.99%, Ge. kilo lots 2s. 8d. per gram	Rhodium, £40/£42 oz.
Gold, 249s. 9d.	Ruthenium, £15/£17 oz. nom.
	Selenium, 50s. 0d. per lb.
	Silver, 76½d. f. oz. spot and 75½d. f'd.
	Tellurium, 15s./16s. lb.

### ORES AND OXIDES

Bismuth .. .. .	65% 8s. 6d. lb. c.i.f.
	18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable) 48%	£17 5s. 0d. per ton c.i.f.
Hard Lumpy 45%	£18 0s. 0d. per ton c.i.f.
Refractory 40%	£12 5s. 0d. per ton c.i.f.
Small 44%	£16 5s. 0d. per ton c.i.f.
Baluchistan 48%	£12 0s. 0d. per ton f.o.b.
Columbite 65% combined oxides, high grade	nom.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF <sub>2</sub> )	156s. 0d. ex works
Lithium Ore—	
Petalite min. 3½% Li <sub>2</sub> O	47s. 6d./52s. 6d. per unit f.o.b. Beira
Lepidolite min. 3½% Li <sub>2</sub> O	47s. 6d./52s. 6d. per unit f.o.b. Beira
Amblygonite basis 7% Li <sub>2</sub> O	£26 5s. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£22 0s. d/d
Manganese Ore Indian—	
Europe (46% - 48%) basis 67s. 6d. freight	nom.
Manganese Ore (43% - 45%)	nom.
Manganese Ore (38% - 40%)	nom.
Molybdenite (85% basis)	8s. 5d. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO <sub>2</sub> (prompt delivery)	£38/£39 per ton c.i.f. Aust'n
Ilmenite 52/54% TiO <sub>2</sub>	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	82s. 0d./85s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 90 - 95% V <sub>2</sub> O <sub>5</sub>	£10 per unit c.i.f.
Zircon Sand (Australian) (65 - 66% ZrO <sub>2</sub> )	£14 5s. per ton c.i.f.

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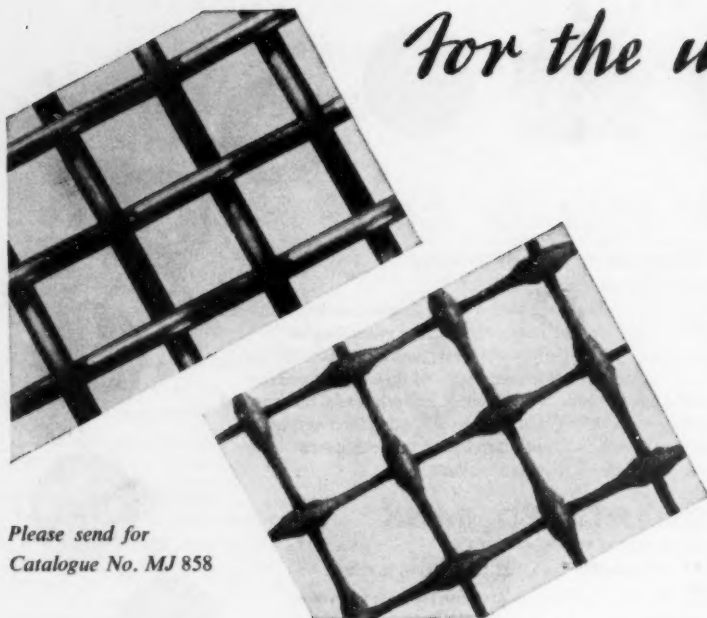
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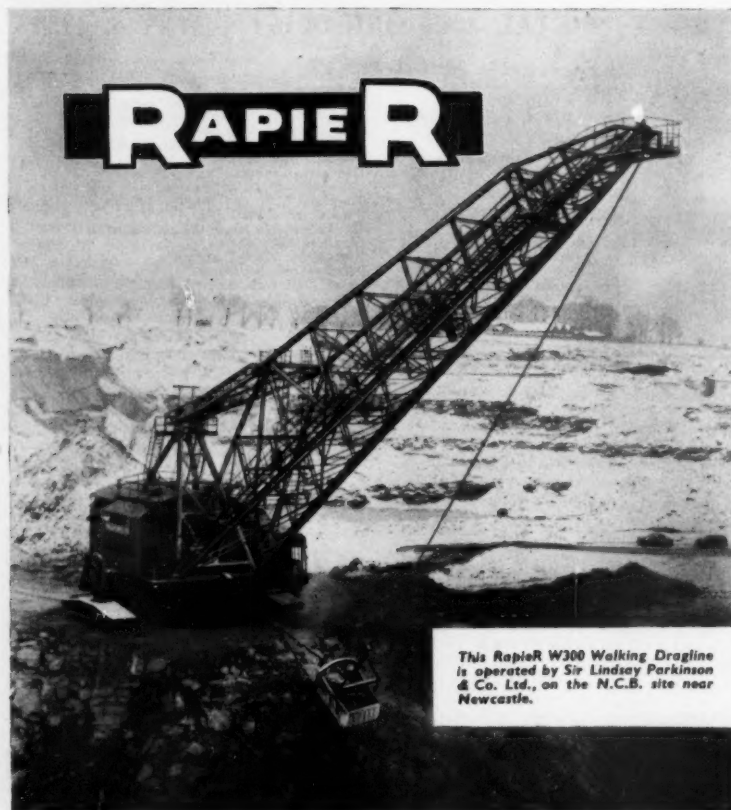
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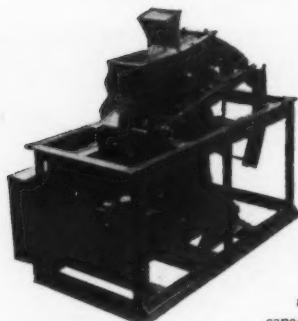
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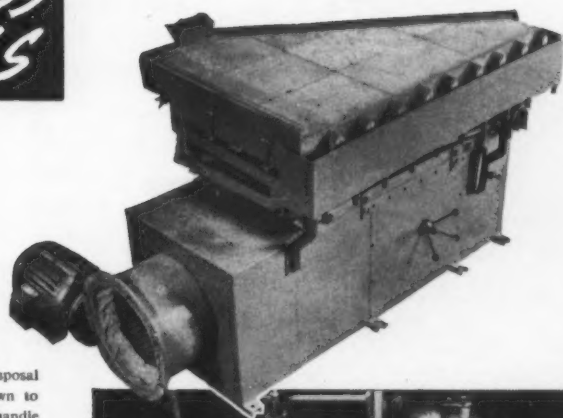
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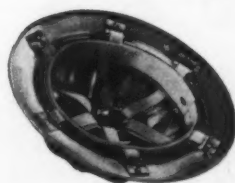
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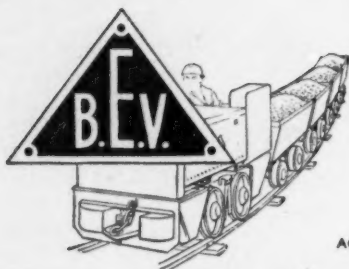
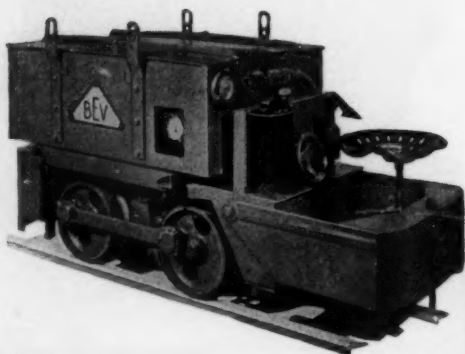


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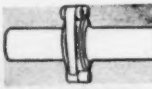
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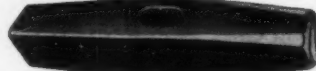
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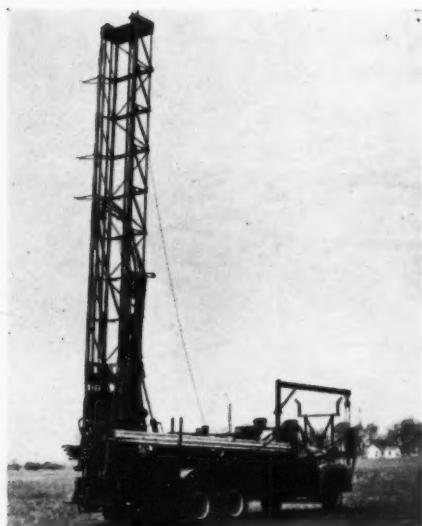
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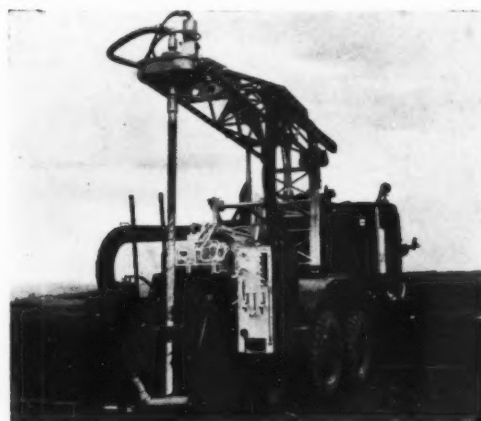


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